Back

FURUNO

OPERATOR'S MANUAL

COLOR DGPS/PLOTTER
COLOR GPS/PLOTTER

MODEL

GP-1650WD, GP-1650W FURUNO/NAVIONICS
GP-1650WD, GP-1650W FURUNO/C-MAP NT

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

(Elemental Chlorine Free)

The paper used in this manual
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Your Local Agent/Dealer

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(TATA) GP-1650W/1650WD

00080935700

OME44240B10

⚠ SAFETY INSTRUCTIONS

⚠ WARNING

Do not open the equipment.

Hazardous voltage which can cause electrical shock, burn or serious injury exists inside the equipment. Only qualified personnel should work inside the equipment.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the switchboard if the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire or electrical shock. Contact a FURUNO agent for service.

Do not operate the equipment with wet hands.

Electrical shock can result.

Use the proper fuse.

Fuse rating is shown on the power cable. Use of a wrong fuse can result in damage to the equipment.

About the TFT LCD

The TFT LCD is constructed using the latest LCD techniques, and displays 99.99% of its pixels. The remaining 0.01% of the pixels may drop out or blink, however this is not an indication of malfunction.

⚠ CAUTION

Do not use the equipment for other than its intended purpose.

No one navigation device should ever be solely replied upon for the navigation of a vessel.

Always confirm position against all available aids to navigation, for safety of vessel and crew.

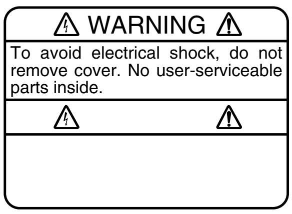
Use the proper gain setting.

Incorrect gain may produce wrong depth indication, possibly result ing in a dangerous situation. See "Adjusting the gain" on page 2-6.

The picture is not refreshed when picture advancement is stopped.

Maneuvering the vessel in this condition may result in a dangerous situation.

A warning label is attached to the equipment. Do not remove the label. If the label is missing or illegible, contact a FURUNO agent or dealer.



Name: Warning Label (1)
Type: 86-003-1011-1
Code No.: 100-236-231

TABLE OF CONTENTS

FOREWORD

A Word to GP-1650WD/1650W Owners

Congratulations on your choice of the FURUNO GP-1650WD COLOR DGPS/PLOTTER, GP-1650W COLOR GPS/PLOTTER. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For over 50 years FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

This equipment is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless installed, operated and maintained properly. Please carefully read and follow the recommended procedures for operation and maintenance.

We would appreciate hearing from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO equipment.

Features

The GP-1650WD provides a totally integrated DGPS beacon receiver, WAAS function, GPS receiver and color video plotter. The GP-1650W mostly shares the same features with the GP-1650WD except it does not have a DGPS beacon receiver.

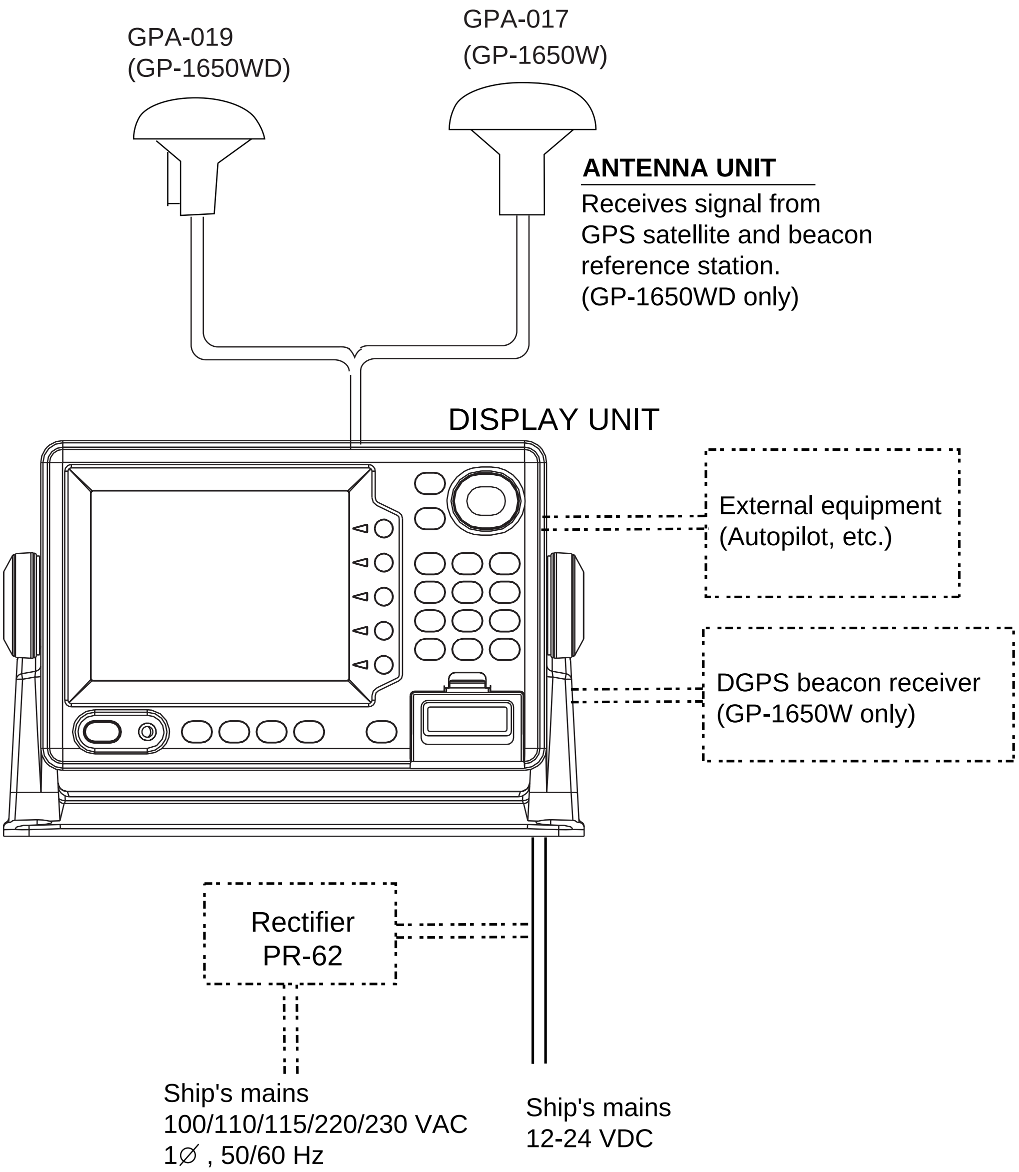
Navigation information is displayed on a bright 5.6-inch color TFT LCD. On-screen information shown are position, range and bearing to cursor position, range, bearing, ETA and TTG to waypoint, etc.
A high sensitivity receiver tracks up to twelve (WAAS: thirteen) satellites simultaneously. An 8-state Kalman filter ensures optimum accuracy in determination of vessel position, course and speed.

C-MAP NT-FP chart card is available for the GP-1650WD/1650W.

The main features of the GP-1650WD/1650W are

- WAAS capability.
- Comprehensive navigation data displays.
- Bright 5.6-inch color TFT LCD with temperature compensated tone and brilliance control.
- Automatic coastline chart loading.
- Position display in latitude and longitude, Loran C or Decca TDs.
- Improved position accuracy with optional DGPS beacon receiver (GP-1650W).
- Accepts both FURUNO and NAVIONICS chart card or FURUNO and C-MAP NT mini chart cards.
- Alarms: Arrival, Anchor Watch, Cross-track Error, Speed and Proximity.
- Man overboard feature records latitude and longitude coordinates at time of man overboard.
- “Highway” display provides graphic presentation of ship’s track and is useful for monitoring cross track error.

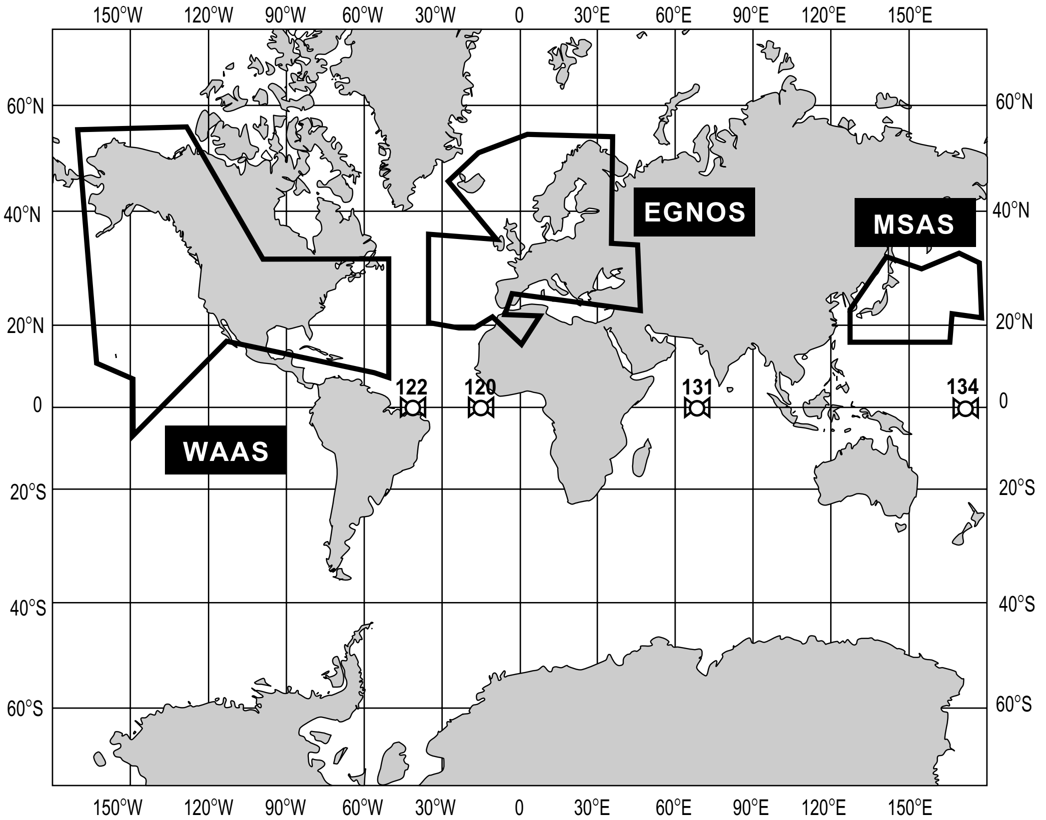
SYSTEM CONFIGURATION



This GPS receiver complies with Canadian standard RSS-210 (Low Power License-Exempt Radio communication Devices).
Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

WHAT IS WAAS?

WAAS, available in North America, is a provider in the worldwide SBAS (Satellite Based Augmentation System) navigation system. An SBAS provider furnishes GPS signal corrections to SBAS users. Two more SBAS providers are also currently under development, MSAS (Multi-Functional Satellite Augmentation System) for Japan and EGNOS (Euro Geostationary Navigation Overlay Service) for Europe. All providers will be compatible with one another, thus providing “seamless” position fixes to SBAS users.



Satellite, Region	Position
120, AOR-E	15.5°W
122, AOR-W	54°W
131, IOR	64.5°E
134, POR	178°E

Initial operation time
WAAS: 2003 EGNOS: 2004 MSAS: 2005

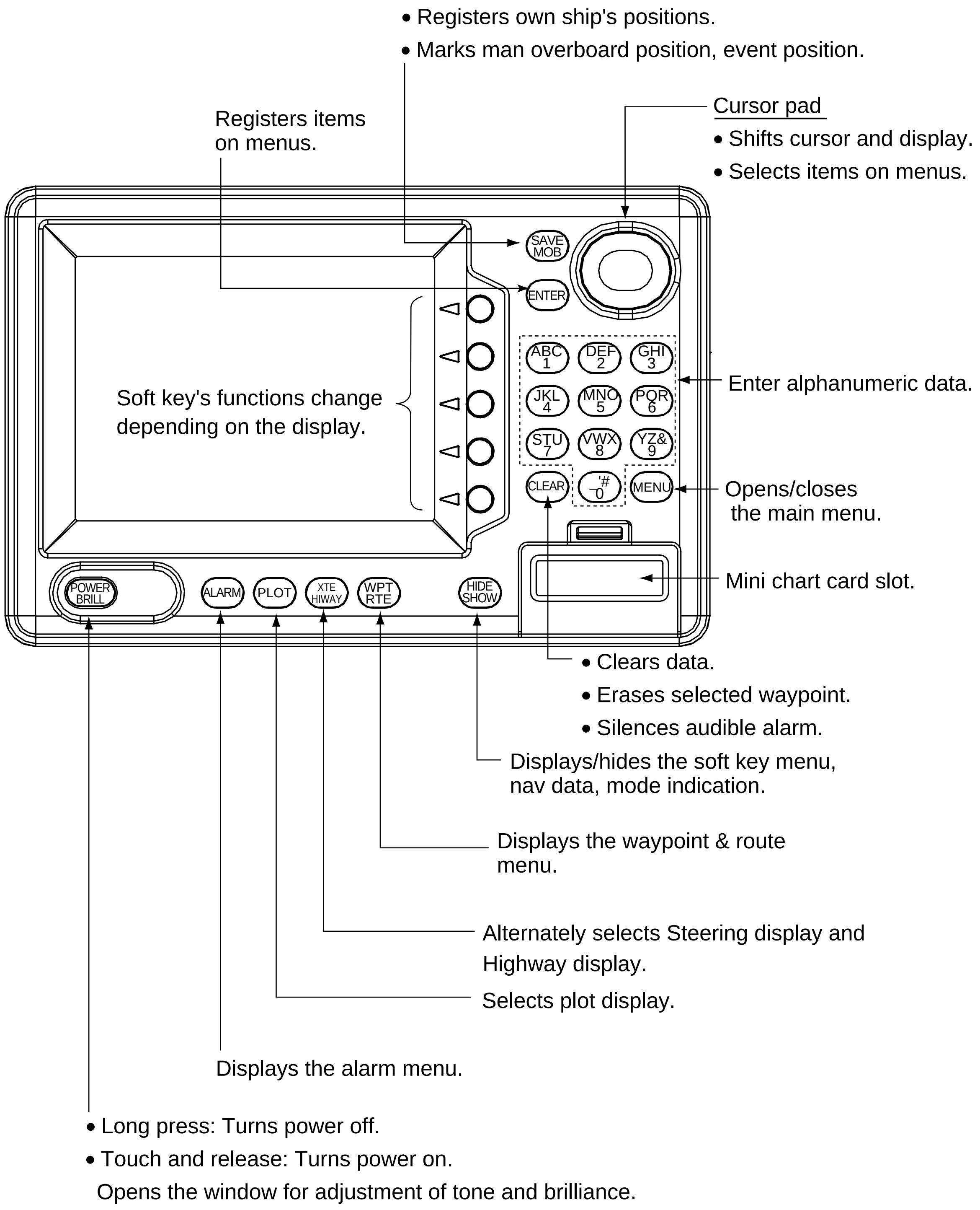
At the time of this software release, SBAS is still under development. (Providers are expected to have initial operations capability from the times shown above.) During this developmental period, which may last for several years, there is no guarantee of the accuracy, integrity, continuity, or availability of the SBAS signal. Furuno will accept no responsibility for the use of the signal for other than the above stated purpose. It is the user’s responsibility to exercise common prudence and navigational judgment while using the SBAS signal in the developmental phase.

Note: This manual uses “WAAS” when referring to any SBAS provider.

1. OPERATIONAL OVERVIEW

This chapter acquaints you with the basics of your unit - from turning on the power to the soft key menu operation.

1.1 Display Unit Controls



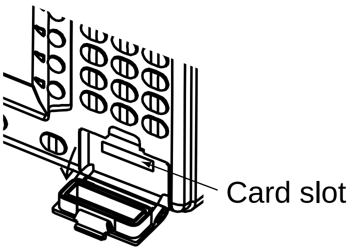
Display unit

1.2 Inserting Mini Chart Card

Insert appropriate mini chart card before turning on the power.

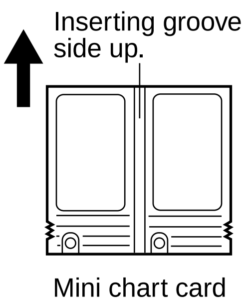
Note: Static electricity can be passed through your fingers to a memory card and destroy the contents of the card. To prevent this, always touch a metallic object, such as a steel desk, before handling a memory card.

1. Push down the lid catch to open the mini chart card slot cover.



Location of mini chart card slot cover

2. Insert appropriate mini chart card groove side up.



Direction of mini chart card

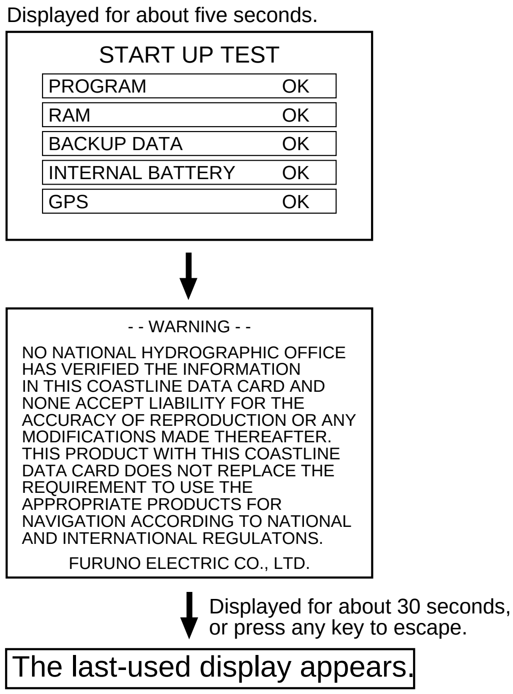
3. Close the slot cover to protect the chart drive. (Keep the slot cover closed at all times.)

Note: Turn off power before inserting or ejecting the mini chart card.

1.3 Turning the Power On/Off

Turning the power on

Press the [POWER/BRILL] key at bottom left-hand side of the display unit to turn on the power. When the unit is turned on, it proceeds in the sequence shown in the figure in below, after displaying the FURUNO information display.



Start-up sequence

For any NG on the start up test display, request service.

The GP-1650WD/1650W takes about 90 seconds to find its position when turned on for the very first time. This is because the equipment has no satellite data, called the Almanac, in its database. If you want to lessen the time needed to find position you may enter your position manually (default position: San Francisco, USA) on the GPS SETUP OPTIONS menu.

Thereafter it takes about 12 seconds to find position each time the power is turned on.

When the satellite signal is being received normally, the GP-1650WD/1650W displays various abbreviations at the bottom left-hand corner of the display which show DGPS/GPS receiver status. The table in below shows these abbreviations and their meanings.

Display abbreviations

Indication	Meaning
GPS 2D	2D (dimension) GPS position fix
GPS 3D	3D GPS position fix
DGPS 2D (GP-1650WD)	2D differential GPS position fix
DGPS 3D (GP-1650WD)	3D differential GPS position fix
NO FIX	Position cannot be found.
DOP	DOP error
DEMO	Simulation mode
GPS W2D	2D WAAS position fix
GPS W3D	3D WAAS position fix

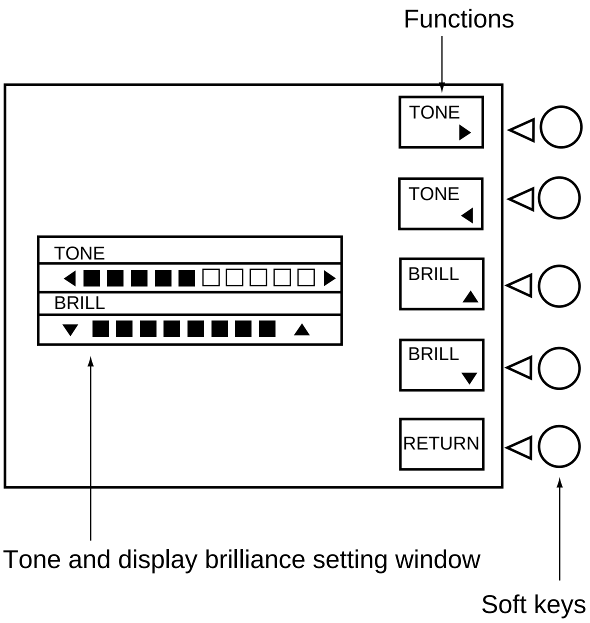
Turning the power off

Press and hold down the [POWER/BRILL] key until the screen goes blank. The time remaining until the power is turned off is shown on the screen.

Note: The example screens shown in this manual may not match the screen you see on your display. The screen you see depends on your system configuration and equipment settings.

1.4 Adjusting Tone and Brilliance

1. Press the [POWER/BRILL] key with a touch-and-release action. The tone and brilliance setting window appears.



Tone and brilliance adjustment window

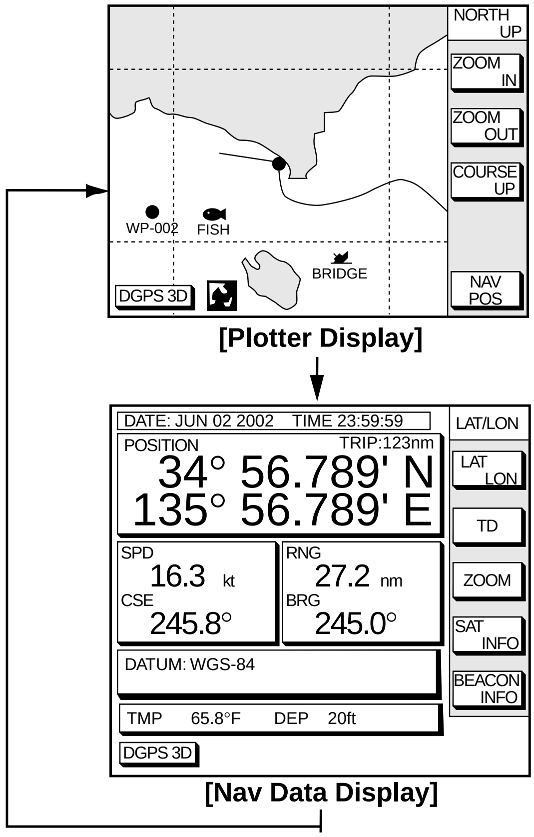
2. Press ◄ or ► on the cursor pad to adjust display tone.
3. Press ▲ or ▼ on the cursor pad to adjust display brilliance.

Note that tone and brilliance can also be adjusted by soft keys. After pressing the [POWER/BRILL] key, use the appropriate soft key to adjust tone or brilliance.

Note: Tone or brilliance must be adjusted within 10 seconds after pressing the [POWER/BRILL] key or the tone and brilliance adjustment window will be erased.

1.5 Plotter Displays

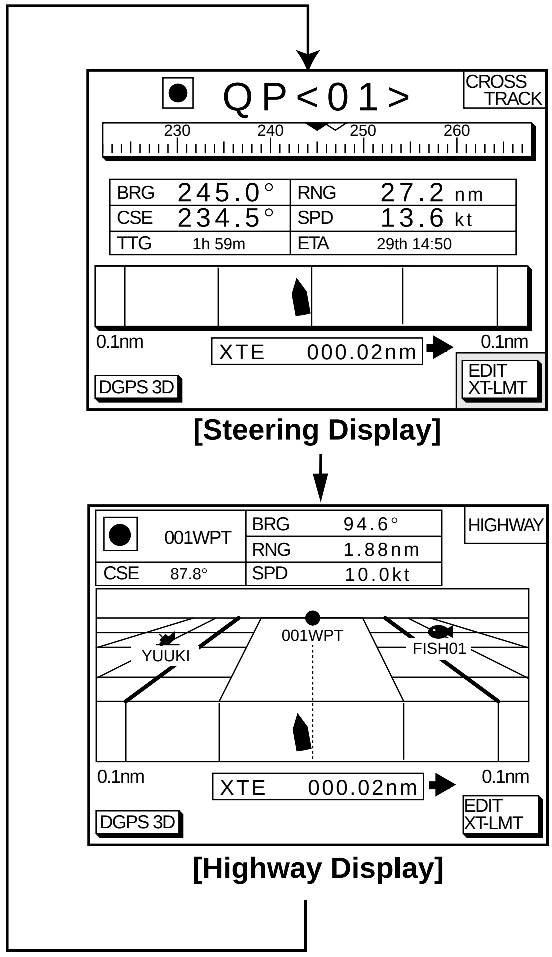
Press the [PLOT] key. Each time this key is pressed, the display mode changes in the sequence shown below. For display mode, refer to Chapter 2.



Display modes (plotter key)

1.6 Steering/Highway Displays

Press the [XTE/HIWAY] key. Each time this key is pressed, the display mode changes in the sequence shown below. For display mode, refer to Chapter 2.

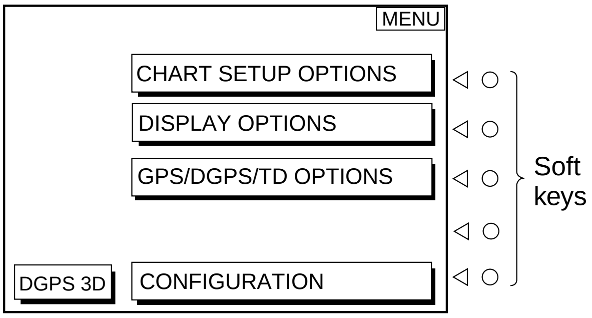


Display modes (XTE/HIWAY key)

1.7 Menu Operation, Soft Keys

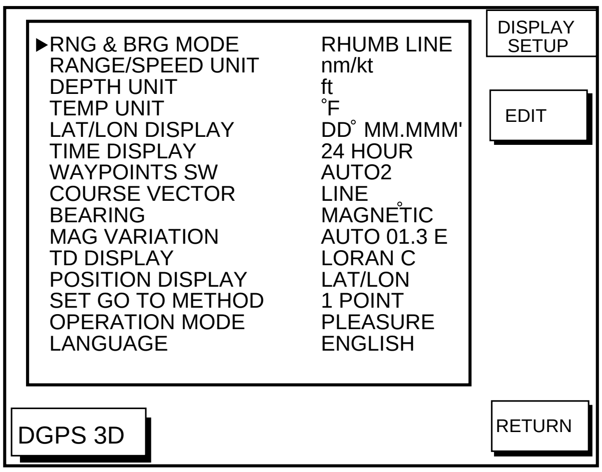
Most operations are carried out through the menu which is opened and closed with the [MENU] key. Menus may be selected with the five soft keys to the right of menus. Options are selected with the cursor pad.

1. Press the [MENU] key to display the main menu.



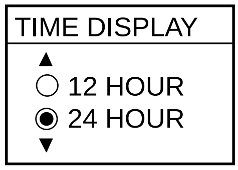
Main menu

2. Press appropriate soft key to display desired menu. For example, press the DISPLAY OPTIONS soft key. The name of the menu in use appears at the top right corner of the display.



Display setup menu

3. Select item with the cursor pad, and press the EDIT soft key. For example, select TIME DISPLAY.



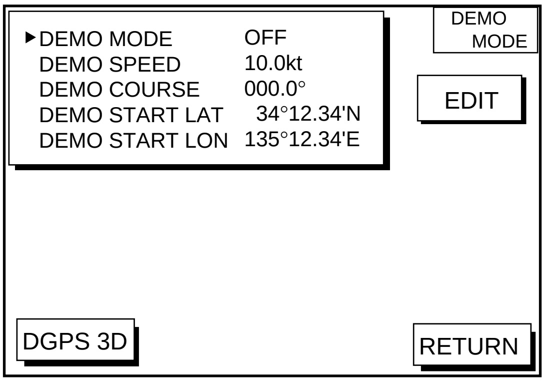
Time display window

4. Use the cursor pad to change the setting.
5. Press the ENTER soft key or [ENTER] key.
6. Press the RETURN soft key.
7. Press the [PLOT] key to finish.

1.8 Demonstration Display

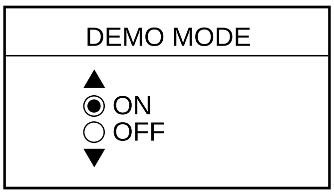
The demonstration display provides simulated operation of this unit. On the plotter display, own ship tracks, at the speed selected, a figure eight course or any course you enter, starting from position entered. All controls are operative; you may set destination, enter waypoints, etc

1. Press the [MENU] key, followed by the CONFIGURATION and SYSTEM MENU soft keys to open the system menu.
2. Press the DEMONSTRATION MODE soft key to open the demonstration setting screen.



Demo setting screen

3. Press ▲ or ▼ to select DEMO MODE.
4. Press the EDIT soft key to show the demo mode window.



Demo mode window

5. Press ▲ to select ON.
6. Press the ENTER soft key or the [ENTER] key.
7. Select DEMO SPEED and press the EDIT soft key. Enter speed. Select digit with ◄/► and enter appropriate numeric value with the numeric keys.
8. Press the ENTER soft key or [ENTER] key.
9. Select DEMO COURSE and press the EDIT soft key. Select how you want the courseline to be traced; by FIGURE 8 or DIR.(ection). For DIR., enter course.
10. Press the ENTER soft key or [ENTER] key.
11. Select DEMO START LAT., and press the EDIT soft key. Enter latitude. Use the N< - > S soft key to switch coordinates if necessary.
12. Press the ENTER soft key or [ENTER] key.
13 Select DEMO START LONG, and press the EDIT soft key. Enter longitude. Use the E< - > W soft key to switch coordinates if necessary.
14. Press the ENTER soft key or [ENTER] key.
15. Press the RETURN soft key.
16. Press the [PLOT] soft key.

To cancel the demonstration display, set DEMO MODE to OFF.

2. PLOTTER DISPLAYS

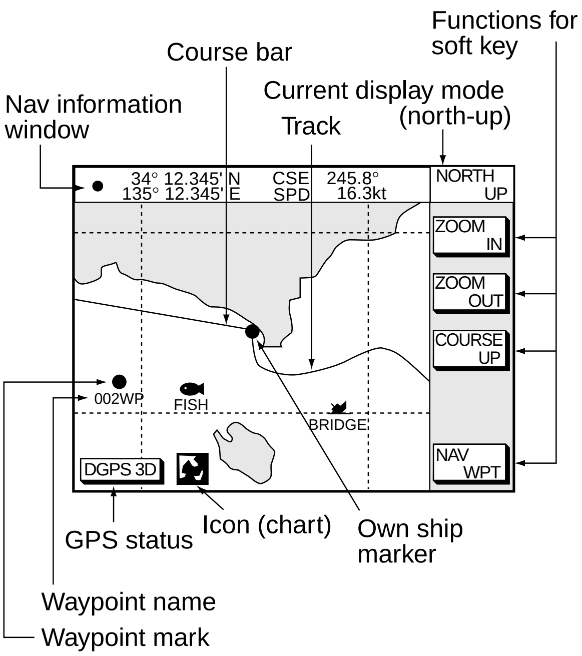
2.1 Presentation Modes

The plotter display mainly shows chart, ship's track, waypoints, and navigation data.

Three types of display presentations are provided for the normal plotter display: north-up, course-up and auto course-up. To change the mode, use the presentation mode selection soft key, which is the 3rd soft key from the top.

North-up

Press the NORTH UP soft key to show the north-up display. North (zero degree) is at the top of the display and own ship is at the center of the screen. Own ship marker is a filled circle. This mode is useful for long-range navigation.

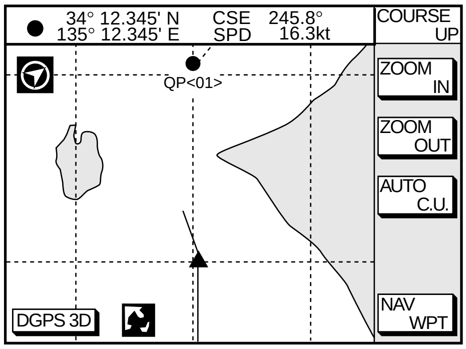


Plotter display, north-up mode

Course-up

Press the COURSE UP soft key to show the course-up display. When destination is set it is at the top of the screen, and the north mark appears at the upper left side of the screen and points to north. A filled triangle marks own ship's position.

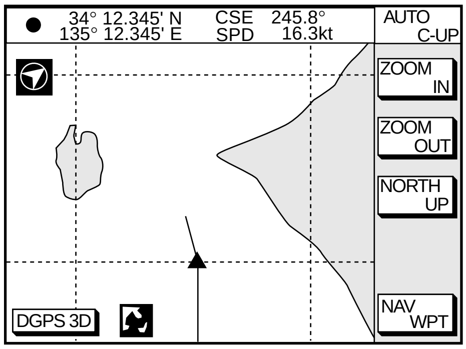
When destination is not set, the course is upward on the screen at the moment the course-up mode is selected.



Plotter display, course-up mode

Auto course-up

Press the AUTO C.U. soft key to show the automatic course-up display. When destination is set it is at the top of the screen, and the north mark appears at the upper left side of the screen and points to north. A filled triangle marks own ship's position. The course is at the top of screen at the moment the automatic course-up mode is selected. When own ship is off its intended course by 22.5° or more, it is automatically brought back to perpendicular.



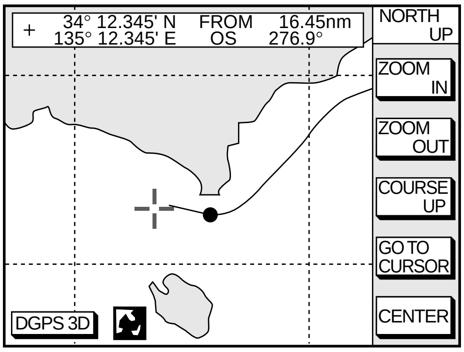
Auto course-up mode

2.2 Cursor

Turning on the cursor, shifting the cursor

Press the cursor pad to turn the cursor on, and the cursor appears at the own ship's position. Operate the cursor pad to shift the cursor. The cursor moves in the direction of the arrow or diagonal pressed on the cursor pad.

Cursor position is displayed in latitude and longitude or Loran or Decca TDs (depending on menu setting) at the top of the plotter display when the cursor is on.



Data displayed on the plotter display when the cursor is on

Turning off the cursor, returning own ship marker to screen center

The CENTER soft key turns off the cursor and returns own ship marker to screen center.

When the cursor is off, own ship position is shown.

2.3 Shifting the Display

The display can be shifted on the plotter display.

1. Press the cursor pad to display the cursor.
2. Locate the cursor at a screen edge. The screen shifts in the direction opposite of cursor location.

2.4 Displaying Nav Information Window

The nav information window can show four data: own ship position, waypoint position, own ship's speed/course and off.

Press the soft key at the bottom of screen. Each press key changes data in the sequence shown below. Soft key name also changes.

NAV POS soft key
Displays own ship's position, course and speed.

↓

NAV WPT soft key
Displays range/bearing to the selected waypoint, chart scale and own ship's course.

↓

NAV S/C soft key
Displays own ship's course/speed and water temperature*/depth.

↓

NAV OFF soft key
Turns off the window.

*: Water temperature sensor is required.

Sequence of pressing the bottom soft key

When the cursor is on, the window at the top of the display shows the cursor position instead of own ship's. To change the window mode when the cursor is on, press the CENTER soft key to show the appropriate soft key.

2.5 Selecting Chart Scale/Range

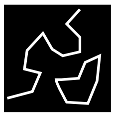
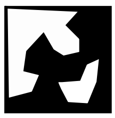
Chart scale (range) may be selected with the ZOOM IN or ZOOM OUT soft key. ZOOM IN expands the chart; ZOOM OUT shrinks it.

2.6 Mini Chart Cards

The mini chart cards contain nautical charts. When you insert a suitable mini chart card in the slot and your boat is near land, a chart appears.

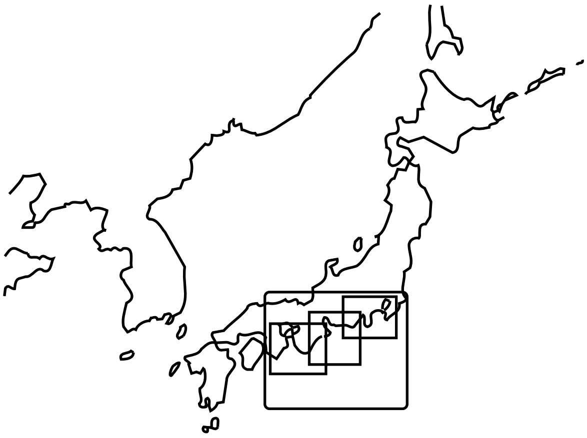
When a wrong card is inserted or a wrong chart scale is selected, the land will be hollow. Insert the proper card and select a suitable chart scale. Chart icons appear to help you select a suitable chart scale. The table below shows the chart icons and their meanings.

Chart icons and their meanings

Icon	Meaning
	Proper card is not inserted or chart scale is too small. Press the soft key ZOOM IN to adjust chart scale.
	Chart scale is too large. Press the soft key ZOOM OUT to adjust chart scale.
	Suitable chart scale is selected.

Indices and chart enlargement

When the ZOOM OUT soft key is used, you will see several frames appear on the chart. These frames are called indices and they show you what parts of the chart can be enlarged in the current picture range. The areas circumscribed with smaller frames can be enlarged, but the area enclosed by the largest frame cannot. These indices can be erased through the menu. See page 10-2.



Sample chart (Japan and South Korea) showing indices

Remarks on chart display

A chart will not be displayed in the following conditions:

- When the chart scale is too large or too small.

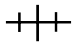
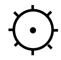
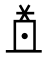
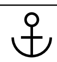
  When this happens, select proper chart scale.
- When scrolling the chart outside the indices.

Chart symbols

FURUNO mini chart card

The table below shows FURUNO mini chart symbols and their meanings.

FURUNO chart symbols

Symbol	Description
	Summit
	Wreck
	Lighthouse
	Lighted Buoy
	Buoy
	Radio Station
	Position of Sounding
	Obstruction
	Fishing Reef
	Platform
	Anchorage

Comparison of FURUNO and Nav-Charts™ chart cards

Item	FURUNO	Nav-Charts™
Dot scrolling capability	YES	YES
Course-up display	YES	YES
Lighthouse data presentation	YES *3	YES
Zoom at cursor position	YES	*1
Range at Equator	0.125, 0.5, 1, 2... 2048 nm	Same as left
Chart offset data entry	YES	YES
Centering	YES	*2

*1 Nav-Charts™ chart may not center the cursor perfectly.

*2 Nav-Charts™ chart may not center own ship's position perfectly.

*3 Newly designed chart cards containing lighthouse data. Chart cards for North America area are completed, and others are in production.

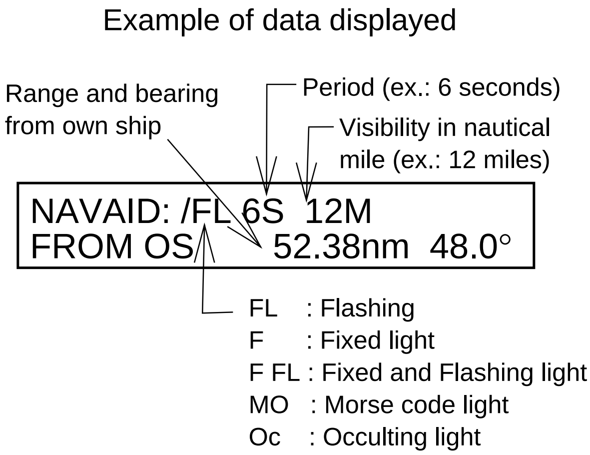
*4 Nav-Charts™ is the registered trademark of NAVIONICS INC.

Aid to navigation data

Selected FURUNO and NAVIONICS mini chart cards can show buoy and lighthouse data. Simply place the cursor on the lighthouse or buoy mark.



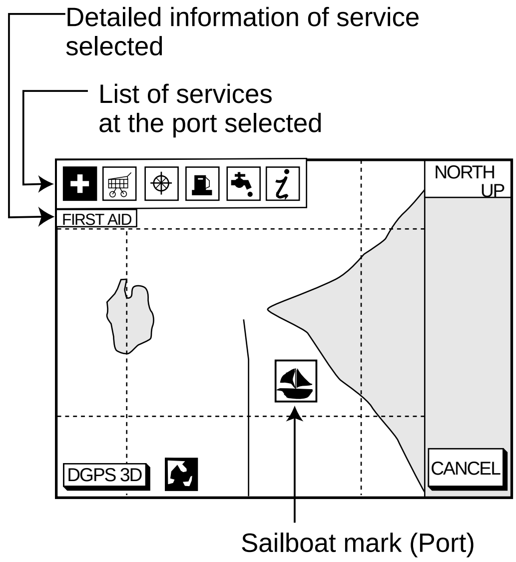
Placing the cursor on the mark



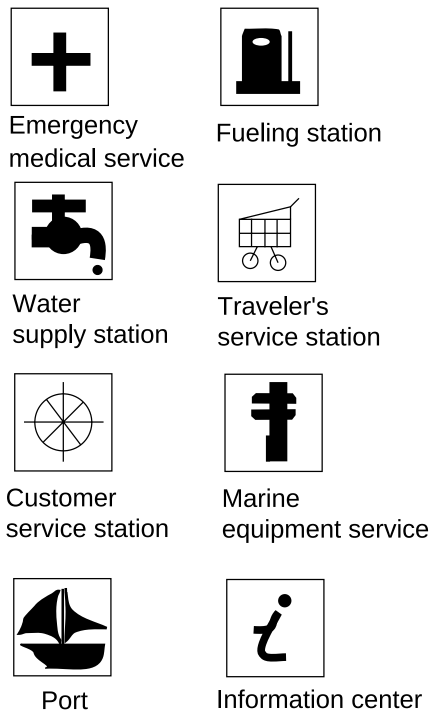
Example of buoy, lighthouse data

Port service icons (Nav-Charts™ cards)

Selected Nav-Charts™ mini chart cards show by icons services available at ports. Use the cursor pad to place the cursor on the sailboat icon (denotes a port or harbor), and then press the [ENTER] key. The services available appear at the top of the display.



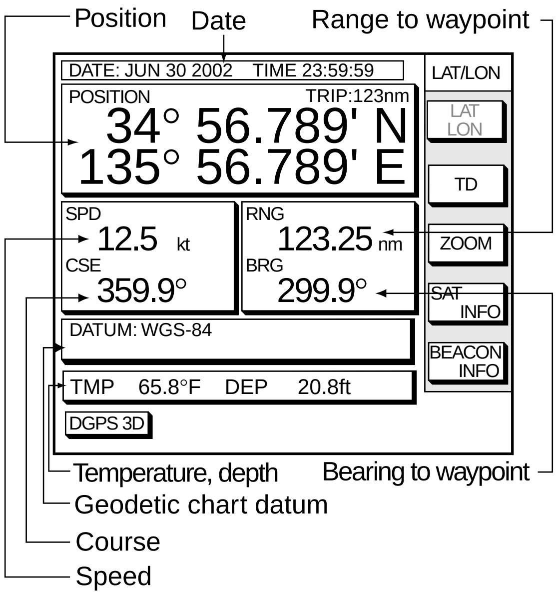
Plotter display showing Nav-Charts™ port service display



Port service icons

2.7 Navigation Data Display

The navigation data display provide generic navigation data and DGPS/GPS information. Press the [PLOT] several times to show the navigation data display.



Navigation data display

The navigation data display shows your position by L/L or TD (Loran-C, Decca). To change position format, press the appropriate LAT/LON or TD soft key.

Enlarging an indication

An indication on the screen may be enlarged as follows:

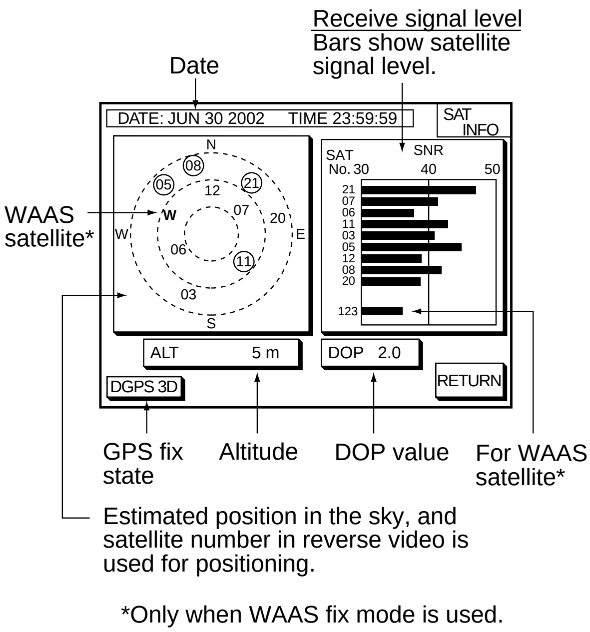
1. Use the cursor pad to select the indication which you wish to enlarge. Selected indication is circumscribed with a red cursor.
2. Press the ZOOM soft key.

To return to the normal nav data display, press the RETURN soft key.

GPS satellite monitor display

The GPS satellite monitor display shows information about GPS satellites.

Press the SAT INFO soft key. Your display should look something like the following illustration.

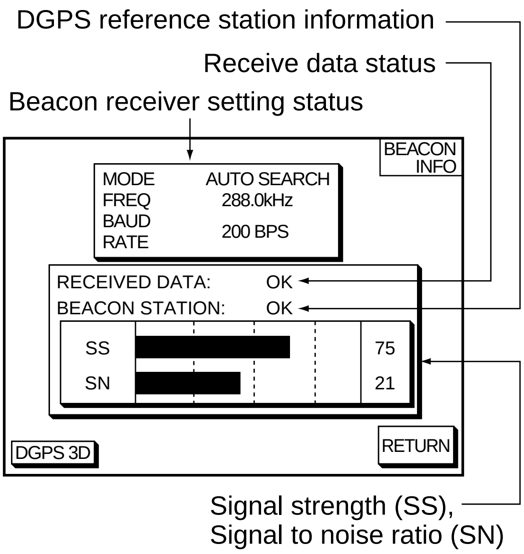


GPS satellite monitor display

To return to the normal navigation data display, press the RETURN soft key.

Beacon information display

The DGPS beacon receiver-equipped model, can show DGPS reference station information. Press the BEACON INFO soft key to show the DGPS reference station information.



Beacon information display

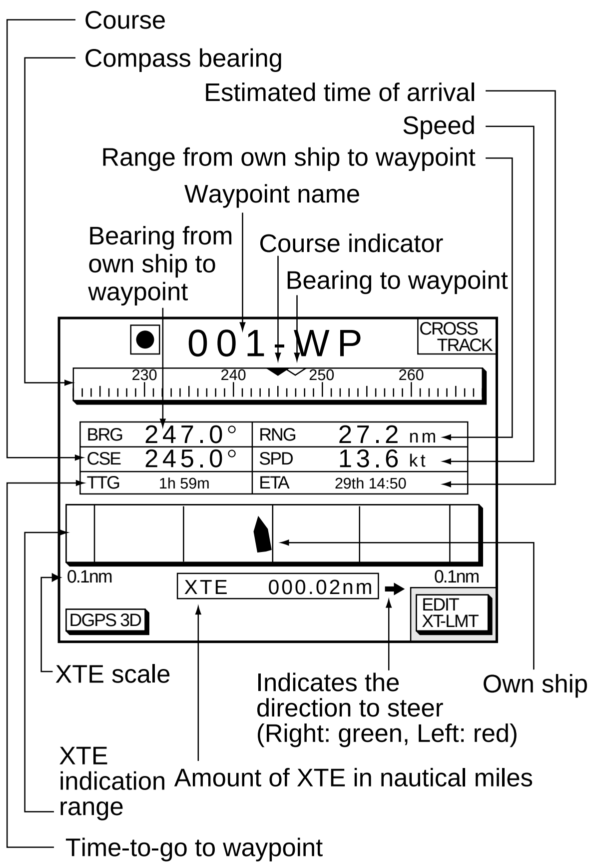
SS: SS (Signal Strength) displays a numeric representation of field strength of the received signal on the selected frequency. The higher the number the stronger the received signal. (should read at least 60.) If noise is present at reception band width, the figure gets bigger.

SN: SN (Signal-to-Noise) ratio displays the ratio between the desired signal and unwanted noise on the selected frequency. The higher the SN ratio the better the quality of the signal. (should read at least 21.)

Note: If your equipment does not have a DPGS receiver, the message “NO DIFFERENTIAL DATA” appears when the BEACON INFO soft key is pressed. Also when connecting with the external beacon receiver, this message appears.

2.8 Steering Display

The steering display provides steering information such as range, bearing, ETA to destination, course and speed.
Press the [XTE/HIWAY] key several times to show the steering display.



Steering display

How to read the compass display

The solid inverted triangle at the center of the compass shows own ship’s course. The hollow inverted triangle shows the bearing to destination waypoint. When own ship’s course is changed, the hollow inverted triangle moves with course change.

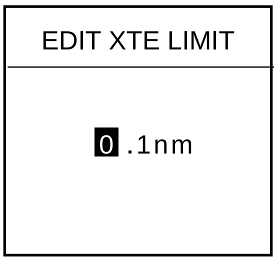
Note: Course means the direction which own ship moves to, it is different from the own ship’s heading. Tide current and wind may affect the course.

How to read the XTE indication

The black boat-shaped mark shows own boat’s movement and direction, and the amount to steer to return to course. Using the figure shown on the previous page as an example, you would steer right by 000.02 nautical miles to return to course. When this mark is out of range of the XTE scale, the mark color changes from black to yellow. The range of the XTE scale can be set as shown below.

Setting the range of the XTE scale

1. Press the EDIT XT-LMT soft key to display the following window.



XTE range setting window

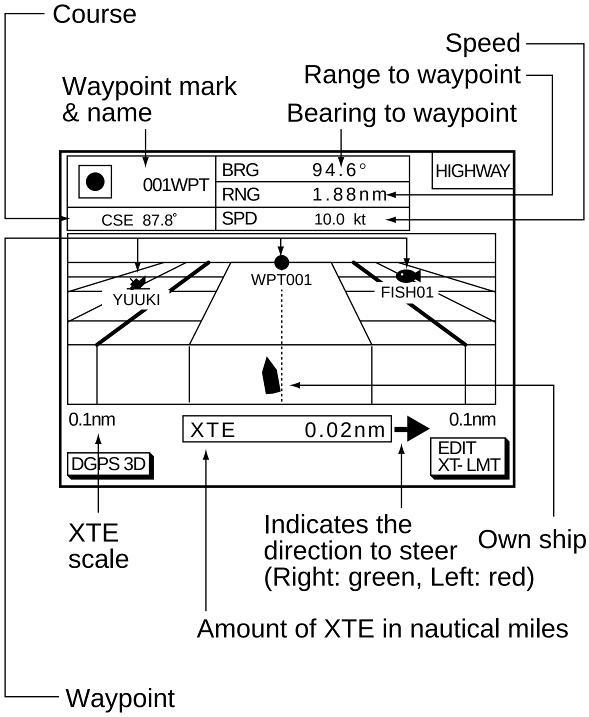
2. Use the cursor pad to select digit to change.
3. Press appropriate alphanumeric key.
4. Press the [ENTER] key. To cancel entry, press the CANCEL soft key instead of the [ENTER] key.

Note that all digits may be cleared by pressing the [CLEAR] key.

2.9 Highway Display

The highway display provides a graphic presentation of ship’s course. It is useful for monitoring XTE - the XTE scale shows direction and amount in nautical miles to steer to return to course. In the figure below, for example, you would steer right by 0.02 nm to return to course.

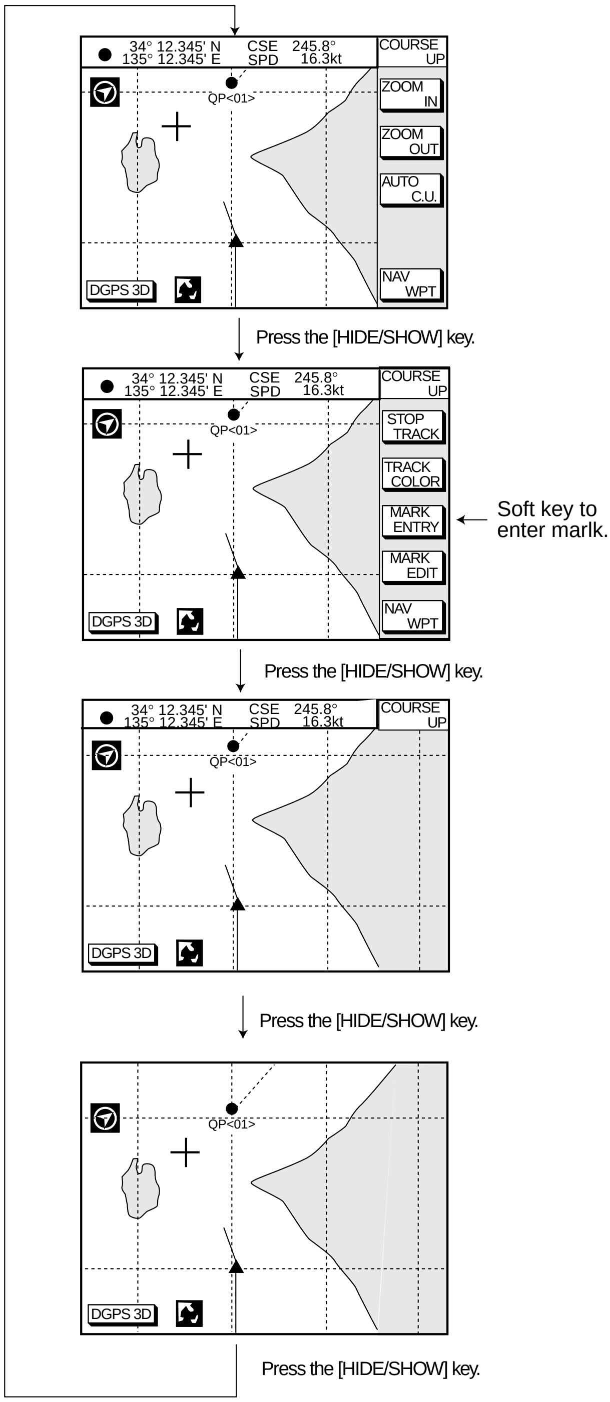
Press the [XTE/HIWAY] key once or twice to show the highway display.



Highway display

2.10 Changing Operation Mode

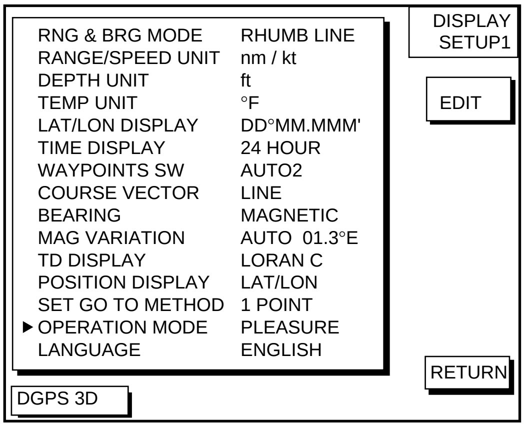
Operation mode can be changed among PLEASURE, FISHING1 and FISHING2. FISHING1 or 2 mode provides mark/line entry at the cursor or own ship's position. On FISHING 1 or 2 mode, pressing the [HIDE/SHOW] key changes the function of soft keys. Holding track, changing track color, and selecting color and form of mark/line can be performed by the soft keys directly. For detailed FISHING mode information, see Chapter 4.



Sequence of pressing the [HIDE/SHOW] key at FISHING 1 or 2 mode

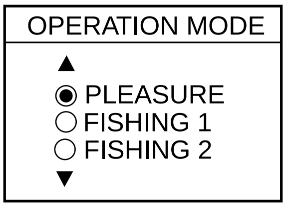
Selecting fishing 1 or fishing 2 mode

1. Press the [MENU] key and the DISPLAY OPTIONS soft key. The display setup1 menu appears.



Display setup1 menu

2. Press ▼ to select OPERATION MODE.
3. Press the EDIT soft key to show the OPERATION MODE window.

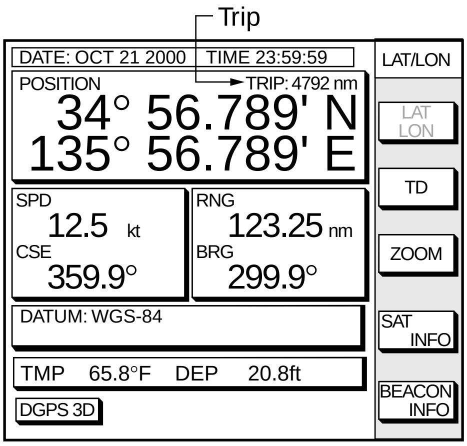


Operation mode window

4. Press ▲ or ▼to select PLEASURE, FISHING1 or FISHING2.
5. Press the ENTER soft key or the [ENTER] key to finish.

2.11 Navigation Trip Distance

The navigation trip distance is displayed on the navigation data display. Press the [PLOT] key several times to show the navigation data display.

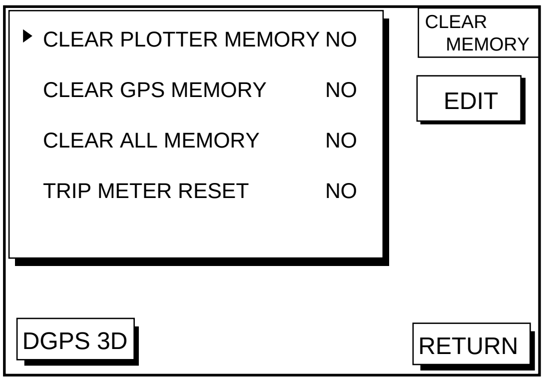


Navigation data display

Note: When you enlarge POSITION, TRIP is not displayed.

Resetting trip distance

1. Press the [MENU] key followed by the CONFIGURATION and SYSTEM MENU soft keys.
2. Press the MEMORY/TRIP CLEAR soft key to open the clear memory menu.



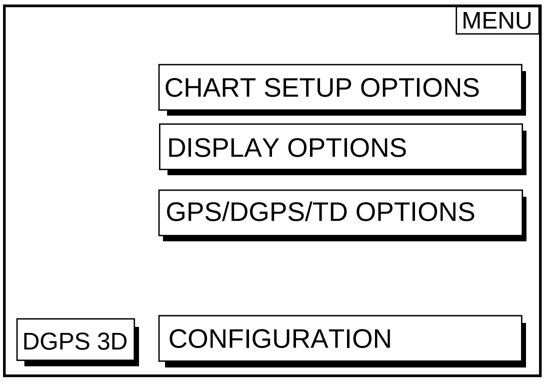
Clear memory menu

3. Press ▼to select TRIP METER RESET.
4. Press the EDIT soft key.
5. Press ▲ to select YES.
6. Press the ENTER soft key or the [ENTER] key to reset trips distance.

3. TRACK

3.1 Displaying Track

1. Press the [MENU] key to open the main menu.



Main menu

2. Press the CHART SETUP OPTIONS soft key to open the CHART SETUP OPTIONS menu.

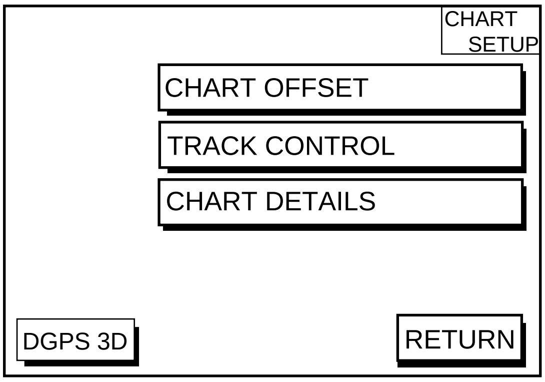
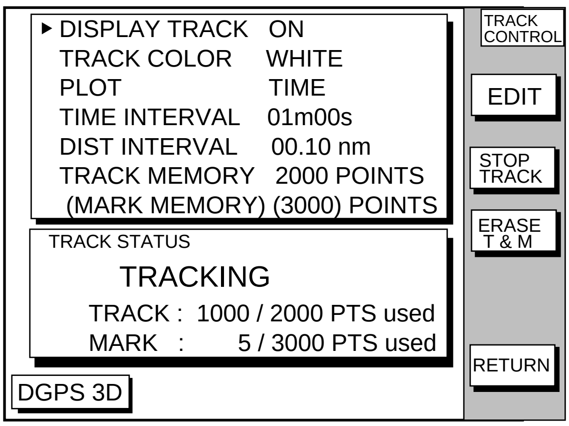


Chart setup menu

3. Press the TRACK CONTROL soft key to open the TRACK CONTROL menu.



Track control menu

4. Press ▲ to select DISPLAY TRACK.
5. Press the EDIT soft key to show the display track window.
6. Press ▲ or ▼ to select ON or OFF as appropriate.
7. Press the ENTER soft key or the [ENTER] key.
8. Press the [PLOT] key to close the menu.

The default setting is ON, which traces ship's track in accordance with ship's movements.

Number of track and mark points used appears in the TRACK STATUS window on the TRACK CONTROL display. Using the illustration at the bottom of the page as an example, it shows that 1000 out of 2000 track points and 5 out of 3000 mark shave been used.

3.2 Stopping/Restarting Plotting of Track

When your boat is at anchor or returning to port you probably won't need to record its track. You can stop recording the track, to conserve the track memory, as follows:

1. Press the [MENU] key followed by the CHART SETUP OPTIONS and TRACK CONTROL soft key.
2. Press the STOP TRACK soft key. The indication "TRACKING" in the TRACK STATUS window changes to "NOT TRACKING".
   On the plotter display, H icon appears.

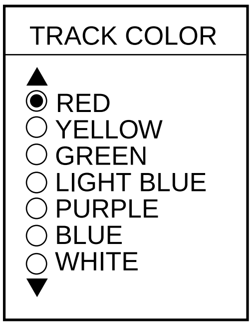
To restart recording the track, press the START TRACK soft key at step 2 in the above procedure.

When the fishing mode is selected, you can stop or restart plotting the track with the soft key only on the plotter display. Press the [HIDE/SHOW] key several times to show the STOP TRACK soft key on the plotter display. Press the STOP TRACK soft key to stop plotting of track. The message of HOLD TRACK PLOTTING appears approx. 2 seconds and then own ship mark changes to hollow circle. To restart plotting the track, press the START TRACK soft key again. The message START TRACK PLOTTING appears approx. 2 seconds and then plotting restarts.

3.3 Changing Track Color

Track can be displayed in red, yellow, green, light-blue, purple, blue or white. It can be useful to change track color to discriminate between previous day's track, past track, etc.

1. Press the [MENU] key followed by the CHART SETUP OPTIONS and TRACK CONTROL soft keys.
2. Press ▲ or ▼ to select TRACK COLOR.
3. Press the EDIT soft key to display the TRACK COLOR window.



Track color window

4. Press ▲ or ▼ to select the color desired.
5. Press the ENTER soft key to finish.

When the fishing mode is selected, you can change track color with the soft key only on the track display.

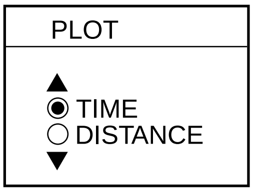
1. Press the [HIDE/SHOW] key several times to show the TRACK COLOR soft key on the plotter display.
2. Press the TRACK COLOR soft key to show the TRACK COLOR window.
3. Press ▲ or ▼ to select the color desired.
4. Press the ENTER soft key or the [ENTER] key to finish, or press the CANCEL soft key to escape.

3.4 Track Plotting Method, Interval

In drawing the track, first the ship's position (fed from the DGPS/GPS receiver, WAAS) is stored into the unit's memory at an interval of time or distance. A shorter interval provides better reconstruction of the track, but the storage time of the track is reduced. When the track memory becomes full, the oldest track is erased to make room for the latest.

Track plotting method

1. Press the [MENU] key followed by the CHART SETUP OPTIONS and TRACK CONTROL soft keys.
2. Press ▲ or ▼ to select PLOT.
3. Press the EDIT soft key to display the PLOT window.



Plot window

4. Press ▲ or ▼ to select TIME or DISTANCE. Distance is useful for conserving track memory, since no track is recorded when the boat is stationary.
5. Press the ENTER soft key or the [ENTER] key.

Track plotting interval

1. Press the [MENU] key followed by the CHART SETUP OPTIONS and TRACK CONTROL soft keys.
2. Press ▲ or ▼ to select TIME INTERVAL or DIST INTERVAL.
3. Press the EDIT soft key to display the INTERVAL window.

TIME INTERVAL
01 m 00 s

(When selecting TIME INTERVAL.)

DIST INTERVAL
00.10 nm

(When selecting DIST INTERVAL.)

Interval window

4. Use the cursor pad to place the cursor on the digit desired. The [CLEAR] key functions to clear an entire line of data.
5. Press appropriate alphanumeric key to enter value.
6. Repeat steps 4 and 5 to complete.
7. Press the ENTER soft key or the [ENTER] key.

3.5 Changing Track Memory Capacity

The equipment stores a total of 5000 points of track and marks. This total may be freely apportioned as desired. The default setting is 2000 points for track and 3000 points for mark. **Note that when the track memory capacity is changed, all tracks and marks in the memory are erased.**

1. Press the [MENU] key followed by the CHART SETUP OPTIONS and TRACK CONTROL soft keys.
2. Press ▼ to select TRACK MEMORY.
3. Press the EDIT soft key to display the TRACK MEMORY window.

TRACK MEMORY
1000/5000 POINTS

Track memory window

The track memory window may be erased by pressing the CANCEL soft key to escape.

4. Enter number of track memory points desired, with the alphanumeric keys.

   Note that all digits may be cleared by pressing the CLEAR soft key or the [CLEAR] key.

5. Press the ENTER soft key or the [ENTER] key. The following window appears to ask you if you are sure to change the track memory capacity.

⚠ RESETTING ERASES TRACK, MARK/LINE ALREADY SAVED. OK?
YES ... "ENTER" key
NO ... "CLEAR" key

Erase message

6. Press the [ENTER] key to change apportion, or press the [CLEAR] key to escape.

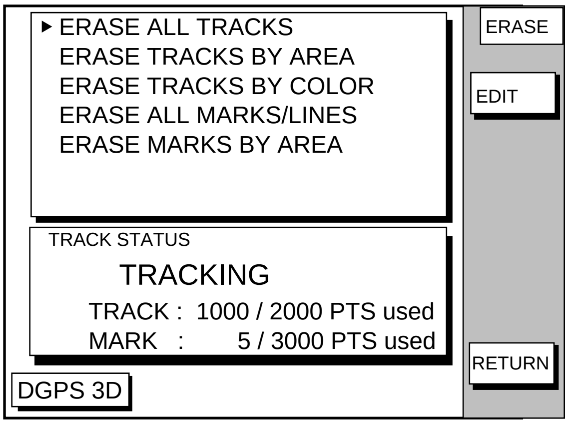
3.6 Erasing Tracks

Be absolutely sure you want to erase track; erased track cannot be restored.

Erasing tracks by area

You can erase tracks within an area you set.

1. Press the [MENU] key followed by the CHART SETUP OPTIONS, TRACK CONTROL and ERASE T & M soft keys.



Erase menu

2. Select ERASE TRACK BY AREA, and then press the EDIT soft key.
3. Move the cursor to the starting point of the area to erase.
4. Press the START soft key.
5. Move the cursor to the ending point of the area to erase.
6. Press the END soft key. You are asked if you sure to erase.
7. Press the [ENTER] key to erase, or press the [CLEAR] key to escape.

Erasing tracks by color

Tracks can be erased by on color.

1. Press the [MENU] key followed by the CHART SETUPOPTIONS, TRACK CONTROL and ERASE T & M soft key.
2. Select ERASE TRACK BY COLOR, and then press the EDIT soft key.
3. Select the color which you want to erase.
4. Press the ENTER soft key or [ENTER] key. You are asked if you are sure to erase.
5. Press the [ENTER] key to erase, or press the [CLEAR] key to escape.

Erasing all track

You can erase all track.

1. Press the [MENU] key followed by the CHART SETUP OPTIONS, TRACK CONTROL and ERASE T& M soft keys.
2. Select ERASE ALL TRACKS, and then press the EDIT soft key.
   You are asked if you sure to erase all track.
3. Press the [ENTER] key to erase, or press the [CLEAR] key to escape.

4. MARK

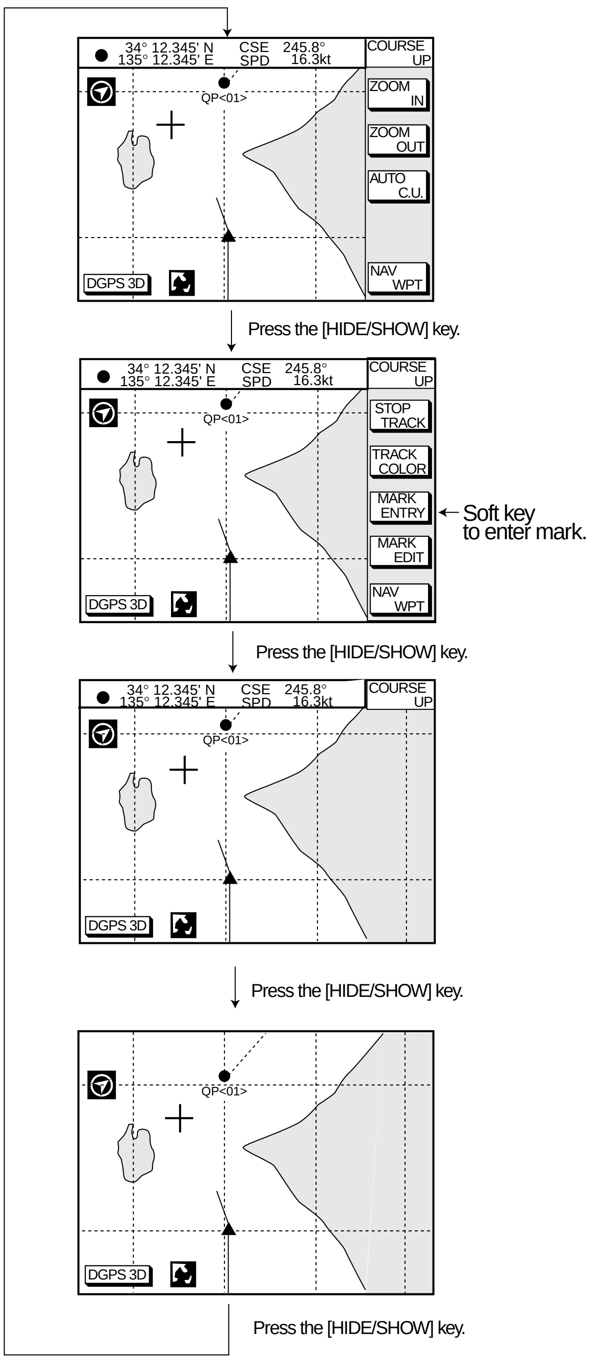
You can enter marks to denote important locations, such as a good fishing spot. In the default condition, you may enter 3000 marks.

4.1 Entering Marks

Select the FISHING 1 or FISHING 2 mode to enable entry of marks on the PLOTTER display. Select the location desired with the cursor, or turn off the cursor to enter the mark at own ship position. Press the MARK ENTRY soft key to enter the mark. The mark is entered in the shape and color selected from the MARK SHAPE and MARK COLOR windows.

In the FISHING 1 or FISHING 2 mode, pressing the [HIDE/SHOW] key changes the function of the soft keys as follows.

Plotter display

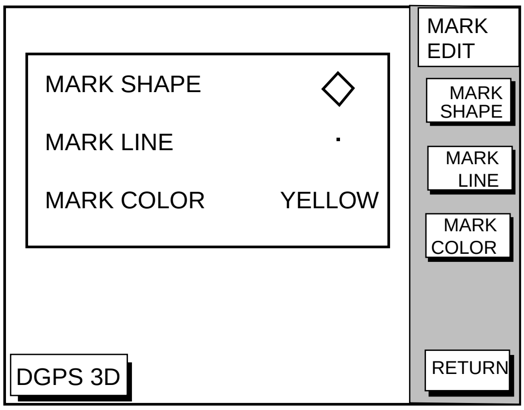


Changing displays (PLOTTER display)

4.2 Changing Mark Attributes

You can select shape, line and color of marks and lines on the plotter display.

1. Press the [HIDE/SHOW] key to show the MARK EDIT soft key.
2. Press the MARK EDIT soft key to show the MARK/LINE window.

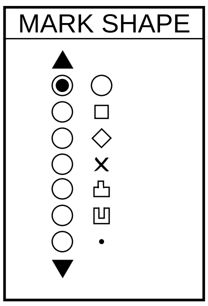


Mark/line window

3. Press the MARK SHAPE soft key to change mark shape, the MARK LINE soft key to change mark line, or the MARK COLOR soft key to change mark color.

Mark shape

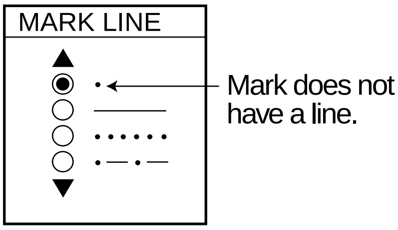
Press the MARK SHAPE soft key to display the MARK SHAPE window. Press ▲ or ▼ to select mark shape desired.



Mark shape window

Mark line

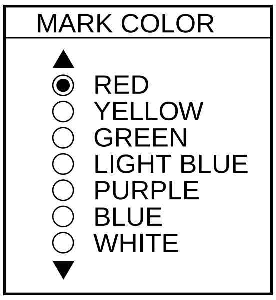
Press the MARK LINE soft key to display the MARK LINE window. Press ▲ or ▼ to select mark line desired.



Mark line window

Mark color

Press the MARK COLOR soft key to display the MARK COLOR window. Press ▲ or ▼ to select mark color desired.



Mark color window

4. Press the ENTER soft key or the [ENTER] key.
5. Press the RETURN soft key to finish.

Marks/lines entered hereafter are inscribed in the shape, color and line type selected here.

4.3 Changing Mark Size

Mark size can be selected from STD (standard) and SMALL.

1. Press the [MENU] key to display the main menu.
2. Press the CHART SETUP OPTIONS soft key.
3. Press the CHART DETAILS soft key to open the CHART DETAILS menu.

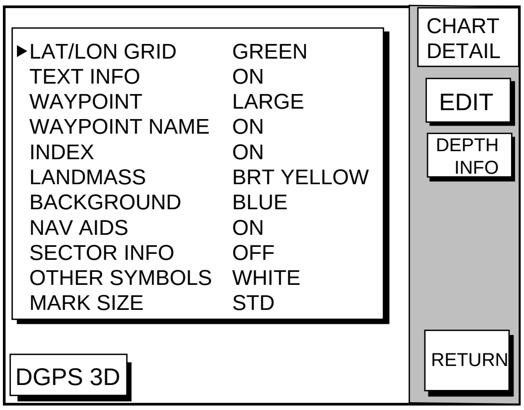


Chart details menu

4. Press ▼ to select MARK SIZE.
5. Press the EDIT soft key.
6. Press ▲ or ▼ to select STD (standard) or SMALL.
7. Press the [ENTER] key.

4.4 Erasing Marks

Erasing individual marks/lines

1. Operate the cursor pad to place the cursor on the mark you want to erase.
2. Press the [CLEAR] key. The mark selected is erased.

   Note: To erase a line, place the cursor on an edge of the line. The line segment will be erased.

Erasing marks/lines in an area

You can erase marks and lines within an area you select.

1. Press the [MENU] key followed by the CHART SETUP OPTIONS, TRACK CONTROL and ERASE T & M soft keys.
2. Press ▲ or ▼ to select ERASE MARKS BY AREA, and then press the EDIT soft key.

   The plotter display appears.
3. Move the cursor to the starting point of the area to erase.
4. Press the START soft key.
5. Press the cursor pad to make a square.
6. Press the END soft key.

   You are asked if you sure to erase the marks/lines in the area you selected.
7. Press the [ENTER] key to erase, or press the [CLEAR] key to escape.

Erasing all marks/lines

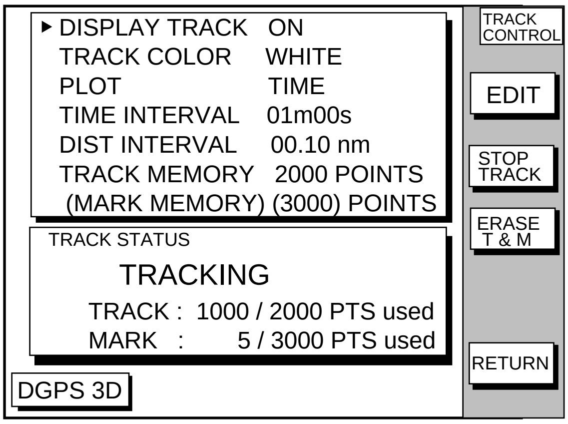
You can erase all marks and lines. Be absolutely sure you want to erase all marks and lines; erased marks and lines cannot be restored.

1. Press the [MENU] key followed by the CHART SETUP OPTIONS, TRACK CONTROL and ERASE T& M soft keys.
2. Select ERASE ALL MARKS/LINES. And then press the EDIT soft key.

   You are asked if you are sure to erase all marks and lines.
3. Press the [ENTER] key to erase, or press the [CLEAR] key to escape.

4.5 Displaying Track and Mark Points

Number of track and mark points used appears in the TRACK STATUS window on the TRACK CONTROL display.



Track control menu

4.6 Target Mark

A target mark (⊗) shows a radar target's position. This mark is inscribed on the plotter display and saved as a waypoint when a certain key is pressed on the radar. Some FURUNO radars can output a target mark to this plotter.

5. WAYPOINTS

5.1 Entering Waypoints

In navigation terminology, a waypoint is a particular location on a voyage whether it be a starting, intermediate or destination point. A waypoint is the simplest piece of information your equipment requires to get you to a destination, in the shortest distance possible. This unit has 835 waypoints (including quick waypoints) into which you can enter position information. There are five methods by which you can enter a waypoint: at own ship's position, at MOB position, by cursor, by range and bearing, and through the waypoint list (manual input of latitude and longitude).

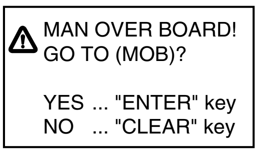
Entering waypoints at own ship's position

You can save your current position as a waypoint. Press the [SAVE/MOB] key with a touch-and-release action to store your position. This new waypoint will automatically be saved in the waypoint list under the next consecutive waypoint number.
For FISHING 2 mode, immediately after pressing the MOB key, you can change the mark shape, color etc. similar to that shown in the procedure on the next page. Press the SAVE soft key to enter the mark.

Entering waypoints at MOB position

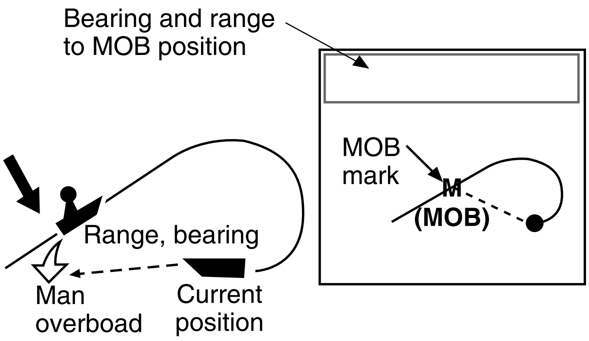
The MOB mark functions to mark man overboard position.

1. When man overboard, press the [SAVE/MOB] key several seconds to display the following message.



MOB message

2. Press the [ENTER] key to select MOB position as destination, or the [CLEAR] key to only mark MOB position.
3. To show range and bearing to the MOB position, press the NAV L/L soft key followed by the NAV WPT soft key.

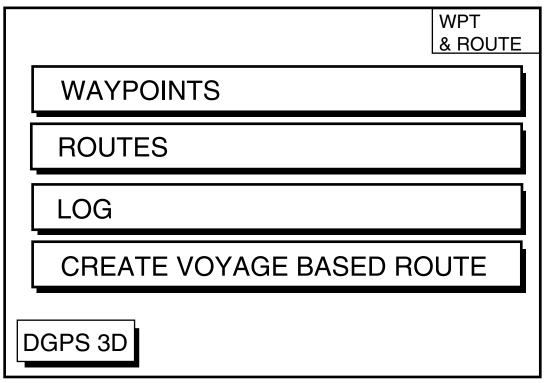


MOB concept

To erase a MOB mark in the PREASURE and FISHING 1 modes, you must erase both the waypoint it is registered under and the MOB mark itself. Place the cursor on the MOB mark and press the [CLEAR] key followed by the [ENTER] key to erase the waypoint. (A flashing diamond appears over the waypoint when it has been correctly selected.) Repeat to erase the MOB mark.

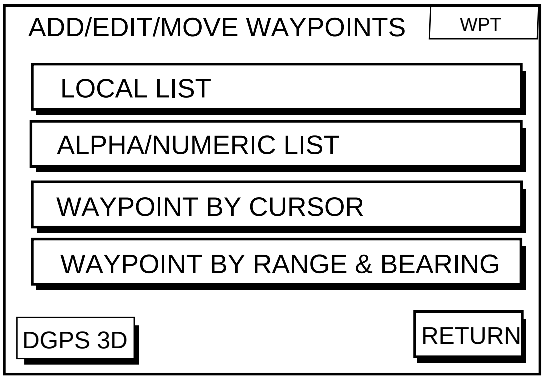
Entering waypoints by the cursor

1. Press the [WPT/RTE] key to open the WAYPOINT & ROUTE menu.



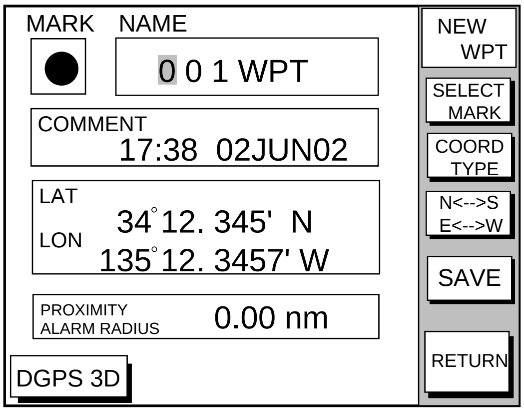
Waypoint & route menu

2. Press the WAYPOINTS soft key to display the WAYPOINTS menu.



Waypoints menu

3. Press the WAYPOINT BY CURSOR soft key. The plotter display appears.
4. Operate the cursor pad to place the cursor on the location desired.
5. Press the NEW WPT soft key. The waypoint window appears and it shows mark shape, waypoint name, comment (default: date), position of waypoint and proximity alarm radius.

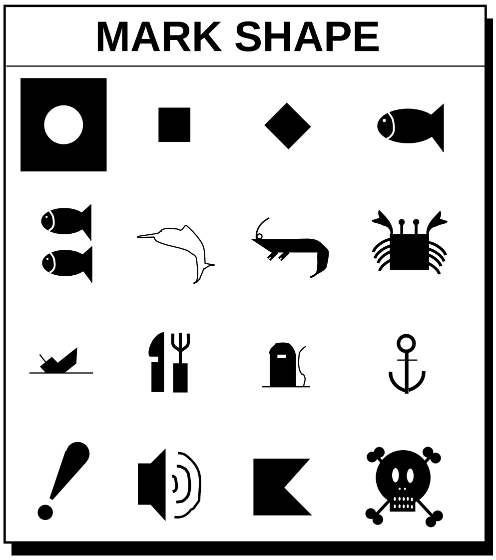


Waypoint window

6. If you do not need to change the waypoint data, simply press the SAVE soft key to register the waypoint and return to the plotter display. If you want to change waypoint data as shown in the next several paragraphs, be sure to press the SAVE soft key only after changing <u>all</u> data you want to change.

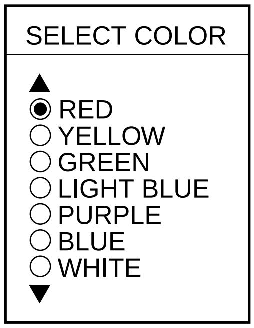
<u>Changing the shape and color of waypoint mark</u>

1. Press the SELECT MARK soft key.
2. Press the MARK SHAPE soft key to open the mark shape selection window.



Mark shape selection window

3. Operate the cursor pad to select shape desired.
4. Press the ENTER soft key or the [ENTER] key.
5. Press the SELECT MARK soft key.
6. Press the MARK COLOR soft key to open the mark color selection window.



Mark color selection window

7. Press ▲ or ▼ to select the color desired, and then press the ENTER soft key or the [ENTER] key.

Changing waypoint name, comment, proximity alarm radius

1. If necessary, you can change the name (up to 6 characters), comment (up to 13 characters), L/L position and the proximity alarm radius (explained in detail in Chapter 8) as follows:
   a) Select the NAME, COMMENT or PROXIMITY ALARM RADIUS field.
   b) Use the cursor pad to select character or digit.
   c) Enter appropriate data with the alphanumeric keys.

Note: You cannot change shape and color of a waypoint when it has a proximity alarm radius entered. To change shape or color, enter all zeroes as the proximity alarm radius.

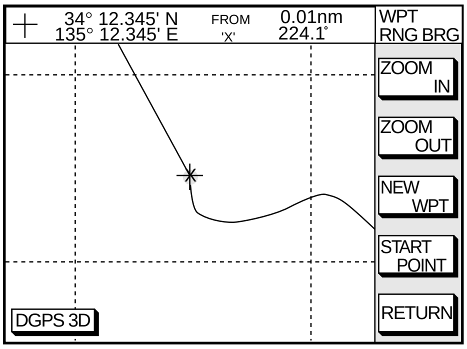
Changing waypoint position

1. Use the cursor pad to place the cursor in the LAT LON field.
2. Operate the cursor pad to place the cursor on digit to change. Enter appropriate data with the alphanumeric keys.
3. You can switch co-ordinates with the N<-->S/E<-->W soft key.

Entering waypoints by range and bearing

This method is useful when you want to enter a waypoint using range and bearing to a target found on a radar.

1. Press the [WPT/RTE] key to open the WAYPOINT & ROUTE menu.
2. Press the WAYPOINTS soft key to open the waypoint menu.
3. Press the WAYPOINT BY RANGE & BEARING soft key. The plotter screen appears.



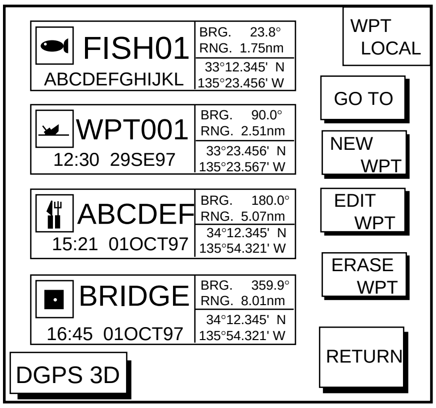
Plotter display, range and bearing selected as waypoint entry method

4. Operate the cursor pad to place the cursor on the location desired. The range and bearing from own ship to cursor appear at the top of the screen.

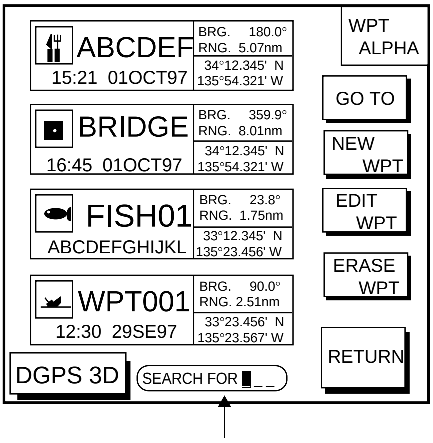
   Note: The origin point of range and bearing can be shifted to the place you desire. Operate the cursor pad to select location, and then press the soft key START POINT. “X” appears at the cursor position.
5. Press the NEW WPT soft key to show the waypoint window.
6. If necessary, change data as you did in “Entering waypoints by the cursor.”
7. Press the SAVE soft key to register the waypoint.

Entering waypoints by latitude and longitude position

1. Press the [WPT/RTE] key to open the WAYPOINT & ROUTE menu.
2. Press the WAYPOINTS soft key to open the WAYPOINT menu.
3. Press the LOCAL LIST (lists waypoints in order from nearest to furthest) or ALPHA/NUMERIC LIST (lists waypoints in alphanumeric order) soft key.



Local list



Search window

Alphanumeric list

4. Press the NEW WPT soft key to show the waypoint window. Own ship’s position is shown. Change the data similar to how you did in “Entering waypoints by the cursor.”
5. Press the SAVE soft key.

5.2 Erasing Individual Waypoints

Individual waypoints can be erased by the cursor or through the waypoint list.

Erasing waypoints by the cursor

1. Press the cursor pad to turn on the cursor.
2. Operate the cursor pad to place the cursor on the waypoint you want to erase. A flashing diamond mark appears over the waypoint when it is correctly selected.
3. Press the [CLEAR] key. You are asked if you are sure to erase the waypoint.
4. Press the [ENTER] key. The waypoint is erased from both the plotter screen and the waypoint list.

Erasing waypoints through the waypoint list

1. Press the [WPT/RTE] key to open the WAYPOINT & ROUTE menu.
2. Press the WAYPOINTS soft key to open the WAYPOINTS menu.
3. Press the LOCAL LIST or ALPHA/NUMERIC LIST soft key.
4. Press ▲ or ▼ to select the waypoint you want to erase.
5. Press the ERASE WPT soft key. You are asked if you are sure to erase the waypoint.
6. Press the [ENTER] key. The waypoint is erased from both the waypoint list and the plotter screen.

5.3 Changing Waypoint Data

You can change the waypoint data through the waypoint list.

1. Press the [WPT/RTE] key, WAYPOINTS, and LOCAL LIST or ALPHA/NUMERIC LIST soft keys.
2. Press ▲ or ▼ to select the waypoint you want to change.
3. Press the EDIT WPT soft key.
4. Change data as you did in “Entering waypoints by the cursor.”
5. Press the SAVE soft key.

5.4 Changing Waypoint Position on the Plotter Display

You may change the position of waypoints on the plotter display as follows:

1. Press the [WPT/RTE] key followed by the WAYPOINTS soft key to open the WAYPOINTS menu.
2. Press the WAYPOINT BY CURSOR soft key. The plotter display appears.
3. Operate the cursor pad to place the cursor on the waypoint which you want to change. A flashing diamond mark appears on the waypoint when it is correctly selected.
4. Press the EDIT/MOVE soft key.
5. Press the MOVE WPT soft key.
6. Operate the cursor pad to place the cursor on the location desired.
7. Press the [ENTER] key.

The waypoint moves to the cursor position and its new position is recorded on the waypoint list. If the waypoint is set as destination or is part of a route, you are asked if you are sure to move the waypoint. In this case, press the [ENTER] key again to move the waypoint, or the [CLEAR] key to cancel move.

5.5 Waypoint Mark Size

You may change the size of all waypoint marks to small or large (default), or turn them off.

1. Press the [MENU] key to open the main menu.
2. Press the CHART SETUP OPTIONS soft key.
3. Press the CHART DETAILS soft key to open the CHART DETAILS menu.

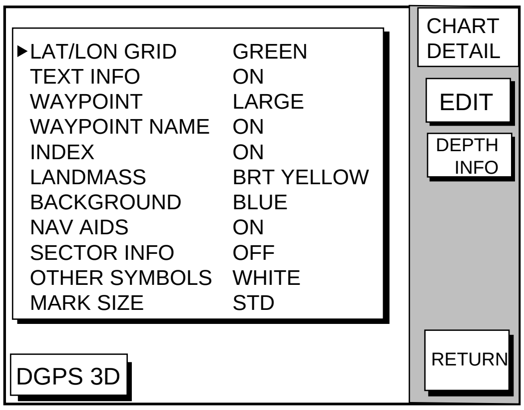


Chart details menu

4. Press ▲ or ▼ to select WAYPOINT.
5. Press the EDIT soft key.
6. Press ▲ or ▼ to select LARGE, SMALL or OFF. LARGE shows mark in actual shape as shown on page 6-2. SMALL displays all waypoints with an “X” regardless of mark shape selected.
7. Press the ENTER soft key or [ENTER] key.

5.6 Searching Waypoints

You can search for a waypoint through the alpha/numeric list as follows:

1. Press the [WPT/RTE] key, and then press the WAYPOINTS and ALPHA/NUMERIC LIST soft keys to show the alphanumeric list. At the bottom of the display the search window appears.



Search window

2. Use the alphanumeric keys to enter the first 1 - 3 characters in the search window. The waypoint searched appears at the top of the screen.

6. ROUTES

Often a trip from one place to another involves several course changes, requiring a series of route points (waypoints) which you navigate to, one after another. The sequence of waypoints leading to the ultimate destination is called a route. Your unit can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.

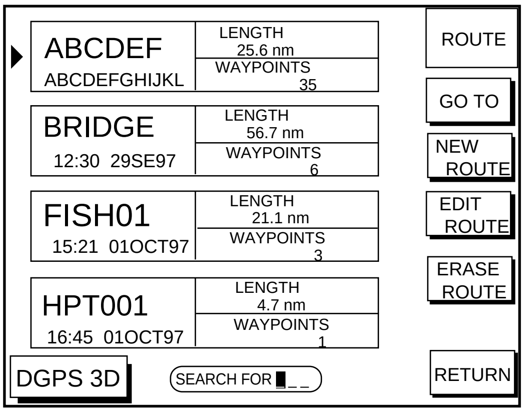
You can store up to 200 routes. A route may consist of 35 points.

6.1 Entering Routes

Entering routes through the route list

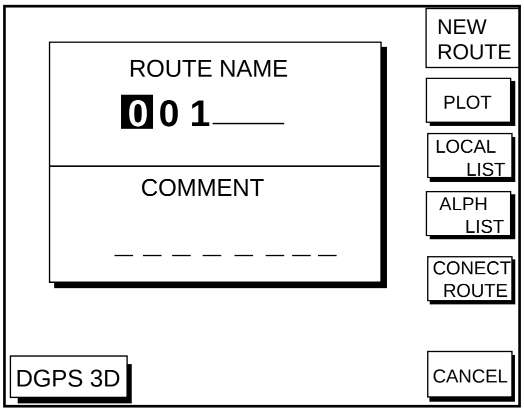
This method constructs routes using existing waypoints.

1. Press the [WPT/RTE] key to open the WAYPOINT & ROUTE menu.
2. Press the ROUTES soft key to open the ROUTE menu.



Route menu

3. Press the NEW ROUTE soft key to open the new route entry window.



New route entry window

4. If desired you can change the route name shown and/or add a comment. To change route name, press the [CLEAR] key to clear the route name. Use the cursor pad to position the cursor and then press appropriate alphanumeric key. To enter a comment, place the cursor in the COMMENT window. Use the cursor pad and alphanumeric keys to enter your comment. A route name may consist of six characters; comment, 13 characters.
5. Press the LOCAL LIST or ALPH LIST soft key to open the waypoint list.
6. Press ▲ or ▼ to select a waypoint, and press the ADD WPT soft key to add it to the route.
7. Repeat step 6 to complete the route.

   When you want to clear a waypoint selected, press the ERASE LST WP soft key. Each press of this key deletes the last waypoint entered.
8. Press the SAVE soft key to register the route.

Entering routes by the cursor

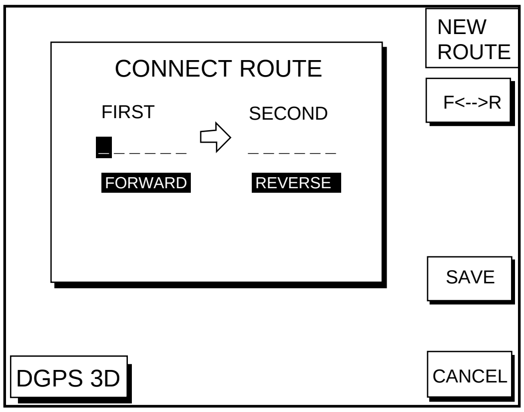
This method allows you to construct a route directly on the plotter display, using existing waypoints or new locations. Any new location will be saved as a waypoint, under the next consecutive waypoint number.

1. Follow step 1-4 in “Entering routes through the route list.”
2. Press the PLOT soft key. The plotter display appears.
3. Operate the cursor pad to place the cursor on an existing waypoint (ADD WPT soft key appears) or new location (ADD NEW WPT soft key appears).
4. Press the ADD WP (ADD NEW WPT) soft key.
5. Repeat steps 3 and 4 to complete the route.
6. Press the [ENTER] key to register the route.

6.2 Connecting Routes

Two routes can be connected as follows:

1. Press the [WPT/RTE] key followed by the ROUTES and NEW ROUTE soft keys to open the NEW ROUTE menu.
2. Enter the name for new route.
3. Press the CONECT ROUTE soft key.
4. Enter the registered route name for the first route beneath FIRST in the CONNECT ROUTE window.



Connect route window

5. Press the F<-->R soft key to select direction to transverse the waypoints of the route; forward or reverse.
6. Enter the route name of the second route similar to how you did for the first route.
7. Press the SAVE soft key.

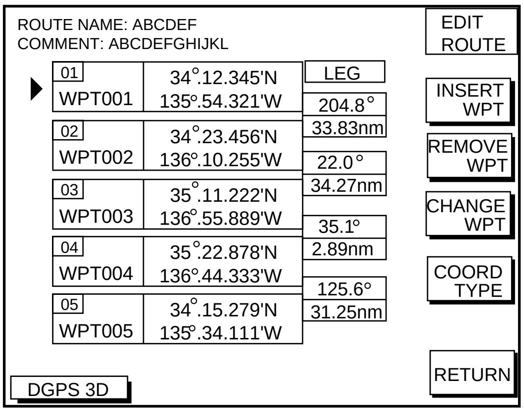
Note: The maximum number of waypoints in a route is 35. If this number is exceeded an error message appears. In this case, delete waypoints in one or both routes so the total number of waypoints does not exceed 35.

6.3 Inserting, Removing Waypoints

Inserting waypoints through the route list

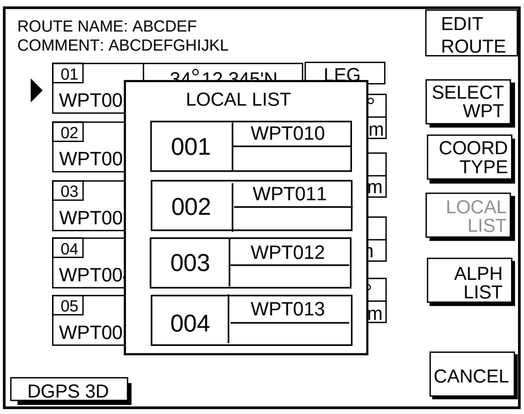
Waypoints can be inserted in routes as follows:

1. Press the [WPT/RTE] key followed by the ROUTES soft key to open the ROUTE menu.
2. Select a route by pressing ▲ or ▼.
3. Press the EDIT ROUTE soft key. The route name screen appears.
4. Press the LOCAL LIST soft key. All waypoints in the route are displayed.



Edit route menu

5. Press ▲ or ▼ to place the cursor at the location where you want to insert a waypoint.
6. Press the INSERT WPT soft key to show the waypoint list.



Waypoint list for editing a route (Local list)

7. Press ▲ or ▼ to select the waypoint you want to insert. You can switch between the local list and alphanumeric list by pressing the LOCAL LIST or ALPH LIST soft key.
8. Press the SELECT WPT soft key.

Changing waypoints through the list

Waypoints used in a route can be changed with others.

1. Press the [WPT/RTE] key followed by the ROUTES soft key to open the ROUTE menu.
2. Select a route by pressing ▲ or ▼.
3. Press the EDIT ROUTE soft key. The route name screen appears.
4. Press the LOCAL LIST soft key.
5. Select the waypoint which you want to change (remove).
6. Press the CHANGE WPT soft key to show the local list.
7. Select the waypoint which you want to change (insert).
8. Press the CHANGE WPT soft key to change the waypoint.
9. Press the [PLOT] key.

Inserting waypoints on the plotter display

Inserting waypoints before the first waypoint or after the last waypoint

1. Press the [WPT/RTE] key followed by the ROUTES soft key to open the ROUTE menu.
2. Press ▲ or ▼ to select the route desired.
3. Press the EDIT ROUTE soft key.
4. Press the PLOT soft key to show the plotter screen.
5. Operate the cursor pad to place the cursor on the first or last waypoint of the route which you want to insert.
6. Press the ADD TO START (ADD TO END) soft key.
7. Operate the cursor pad to place the cursor on an existing waypoint (ADD WPT soft key appears) or new location (ADD NEW WPT soft key appears).
8. Press the ADD WPT (ADD NEW WPT) soft key.
9. Press the [ENTER] key.

When you want to insert waypoints after the last waypoint, press the “ADD TO END” soft key at step 6.

Inserting waypoints in an intermediate location within a route

1. Follow steps 1 through 4 in “Inserting waypoints before the first waypoint or after the last waypoint.”
2. Operate the cursor pad to place the cursor on a line connecting waypoints.
3. Press the SPLIT LEG soft key. The selected line turns red.
4. Operate the cursor pad to place the cursor on an existing waypoint (INSERT WPT soft key appears) or new location (INSERT NEW WPT soft key appears).
5. Press the appropriate soft key, INSERT WPT or INSERT NEW WPT.

Removing waypoints from routes

Removing route waypoints through the route list

1. Press the [WPT/RTE] key followed by the ROUTES soft key to open the ROUTE menu.
2. Press ▲ or ▼ to select the route desired.
3. Press the EDIT ROUTE and LOCAL LIST soft keys to show the waypoint list.
4. Press ▲ or ▼ to select the waypoint you want to delete.
5. Press the REMOVE WPT soft key.

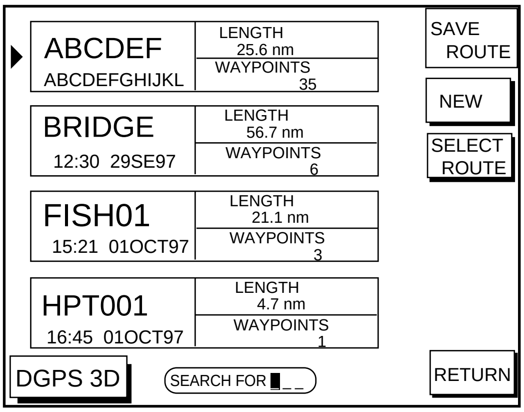
Removing route waypoints from the plotter display

1. Press the [WPT/RTE] key followed by the ROUTES soft key to open the ROUTE menu.
2. Press ▲ or ▼ to select the route desired.
3. Press the EDIT ROUTE soft key.
4. Press the PLOT soft key to show the plot screen.
5. Operate the cursor pad to place the cursor on the waypoint you want to remove from the route.
6. Press the REMOVE WPT soft key.

6.4 Creating Track-based Routes

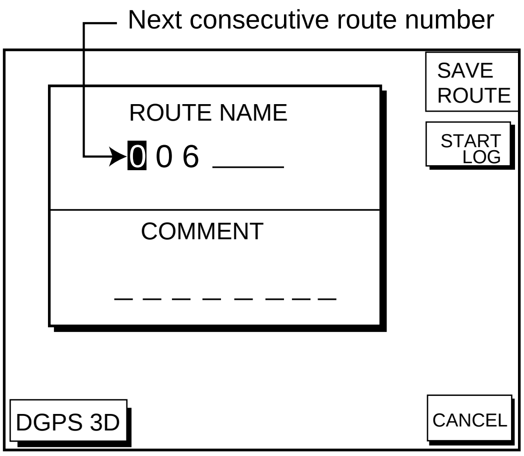
You can create routes based on your ship's track by entering waypoints at own ship's position. This feature is useful when you wish to retrace a track.

1. Press the [WPT/RTE] key to open the WAYPOINT & ROUTE menu.
2. Press the CREATE VOYAGE BASED ROUTE soft key to show the save route menu.



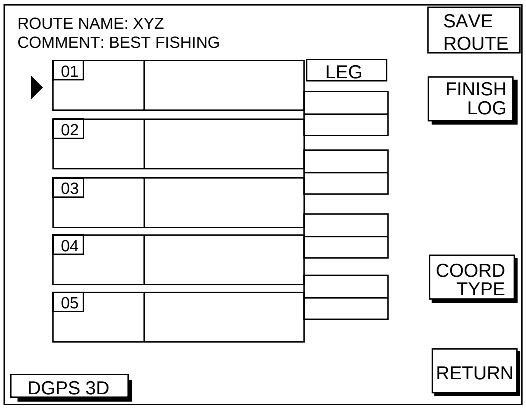
Save route menu

3. Press the NEW soft key to show the new route window.



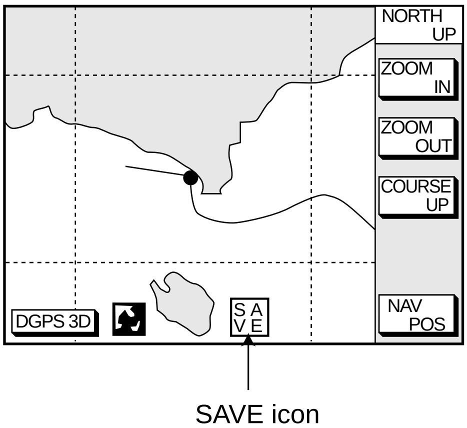
New route window

4. If required, you may change the route name and enter a comment, using the [CLEAR] key, cursor pad and alphanumeric keys.
5. Press the START LOG soft key to show the track-based route screen. If you entered an existing route name at step 4, you are asked if you want to add track-based waypoints to the existing route. Then, press the [ENTER] key to select YES, or the [CLEAR] key to escape.



Route contents display

6. Press the [PLOT] key to show the plot display. The SAVE icon appears at the bottom of the screen.



SAVE icon appearance on the plotter display

7. Press the [SAVE/MOB] key with a touch-and-release action to enter a waypoint mark at own ship position. A new waypoint is created under the next consecutive waypoint number and that waypoint is added to the route.
8. Repeat step 7 whenever you change course. 35 waypoints can be entered.
9. To stop creating the track-based route, press the [WPT/RTE] key followed by the CREATE VOYAGE BASED ROUTE soft key.
10. Press the FINISH LOG soft key to register the route. The SAVE icon disappears.

6.5 Erasing Routes

1. Press the [WPT/RTE] key followed by the ROUTES soft key to open the route menu.
2. Press ▲ or ▼ to select a route you want to erase.
3. Press the ERASE ROUTE soft key. You are asked if you are sure to erase the route.
4. Press the [ENTER] key to erase the route.

7. NAVIGATION

7.1 Navigating to “Quick Points”

The “quick point” feature allows you to navigate to point(s) without retaining the data indefinitely in your unit’s memory. Each time a quick point is entered previous quick points have the same numbers as newly entered ones are written over.

Selecting quick point entry method

You need to tell your unit how to set the quick point: 1 POINT, 35 POINT (up to 35 points) or WPT/PORT SERV. (For WPT/PORT SERV, see the next page.)

1. Press the [MENU] key.
2. Press the DISPLAY OPTIONS soft key.
3. Select SET GO TO METHOD and press the EDIT soft key. The following display appears.

```
SET GO TO METHOD
▲
◉ 1 POINT
○ 35 POINT
○ WPT/PORT SER
▼
```

SET GOTO METHOD window

4. Select method desired.
5. Press the ENTER soft key.
6. Press the RETURN soft key to finish.

Navigating to a single quick point

1. Select 1 POINT in “Selecting quick point entry method,” and return to the plotter display.
2. Place the cursor on an existing waypoint (GO TO WPT soft key appears) or a new location (GO TO CURSOR soft key appears).
3. Depending on the selection you made at step 2, press the GO TO CURSOR or GO TO WPT soft key.

A light-blue line connects between own ship and destination, marked “QP<01>”, and it shows the shortest course to the destination. Arrows on the line show the direction to follow to get to the quick point. Range and bearing from own ship to the destination appear at the top of screen. This location is saved to the waypoint list as waypoint “QP01.”

Navigating to multiple quick points

1. Select 35 POINT in “Selecting quick point entry method,” and return to the plotter display.
2. Press the GO TO soft key.
3. Place the cursor on an existing waypoint (SELECT WPT soft key appears) or a new location (ADD QP soft key appears).
4. Depending on the selection you made at step 3, press the SELECT WPT or ADD QP soft key. “QP<01>” appears at the cursor location. To erase last-entered waypoint, press the ERASE LST WPT soft key.
5. Repeat steps 3 and 4 to enter other quick points.
6. After entering all waypoints (up to 35 points), press the [ENTER] key to register the route.

A light-blue line connects between own ship and all quick points, and it shows the shortest course to destination. Arrows on the line show the direction to follow the route. Quick points are numbered in sequential order from QP<01> and are saved to the waypoint list. Range and bearing from own ship to the first destination appear at the top of screen. The unit saves the points as a route, under the name “Q<RTE>” (Quick Route).

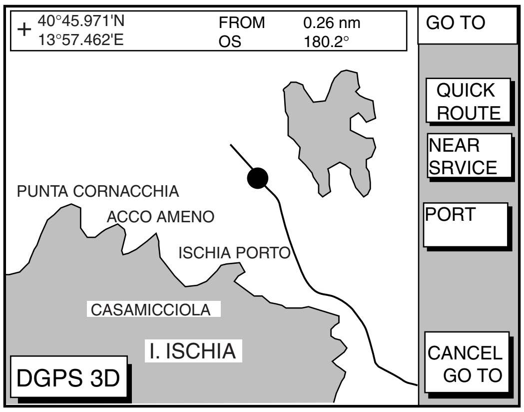
7.2 Navigating to Waypoints (waypoint list)

1. Press the [WPT/RTE] key to open the WAYPOINT & ROUTE menu.
2. Press the WAYPOINTS soft key to open the WAYPOINTS menu.
3. Press the LOCAL LIST or ALPHA/NUMERIC LIST soft key to show corresponding waypoint list.
4. Select a waypoint.
5. Press the GO TO soft key. The plotter display appears. A light-blue line runs between destination selected and own ship's position. Arrows on the line show the direction to follow. Waypoint data appear at the top of screen.

7.3 Navigating to Ports, Port Services

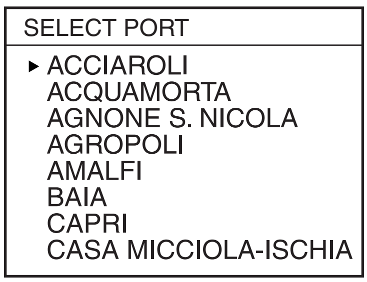
Some Nav-Charts™ and C-MAP chart cards have a port service list which shows services available at ports or harbors. (See page 2-5.) You can use the list to set destination as follows:

1. Press the [MENU] key to open the main menu.
2. Press the DISPLAY OPTIONS soft key.
3. Press ▼ to select SET GO TO METHOD and press the EDIT soft key.
4. Press the ▲ or ▼ to select WPT/PORT SER and press the [ENTER] key or the ENTER soft key.
5. Press the [PLOT] key to return to the plotter display.
6. Press the GO TO soft key. Soft key titles change as in the figure below.

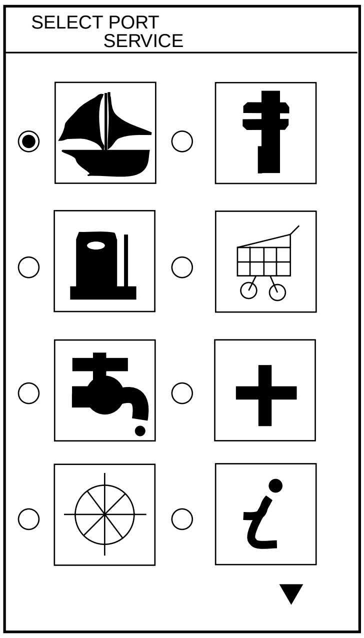


Plotter display

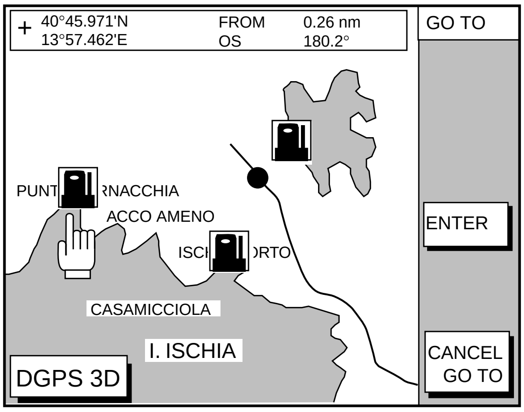
7. Press the PORT or NEAR SRVICE soft key depending on objective. PORT shows a list of ports in your area. NEAR SRVICE displays the port service list.



Sample port list (southern Italy)



Sample port service list



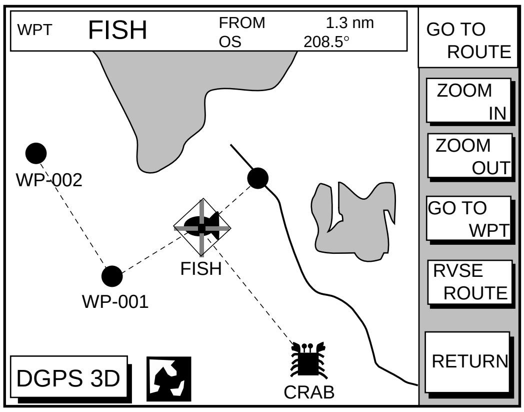
Sample filling station locations (southern Italy)

8. **If you selected PORT at step 7,** use the cursor pad to select a port and press the [ENTER] key. Make a route using the soft keys and press the [ENTER] key. (If you want to go directly to that port, simply press the ADD QP soft key followed by the [ENTER] key.)

   If you selected NEAR SERVICE in step 7, select service mark desired and then press the ENTER soft key. Then, the display shows the locations of those services nearest you. (The figure at right shows the location of filling stations in an area in southern Italy.) Use ▲ or ▼ to place the "hand cursor" on the port service icon desired and press the ENTER soft key. Make a route using the soft keys and press the [ENTER] key. (If you want to go directly to location selected, simply press the ADD QP soft key followed by the [ENTER] key.)

7.4 Following a Route

1. Press the [WPT/RTE] key followed by the ROUTE soft key to open the route list.
2. Press ▲ or ▼ to select a route.
3. Press the GO TO soft key to show the plotter display.



Plotter display, route selected as destination

The cursor is on the route waypoint nearest own ship.

4. Operate the cursor pad to place the cursor on the waypoint or leg desired in the route.
5. Press the GO TO WPT or FOLLOW LEG soft key (depending on the choice made at step 4).

Green lines connect all route waypoints and arrows on the lines point in the direction to traverse the route.

Navigate route waypoints in reverse order

Press the RVSE ROUTE soft key to reverse the order to traverse waypoints. The arrows on the route line point in the direction selected.

Navigate directly to a route waypoint

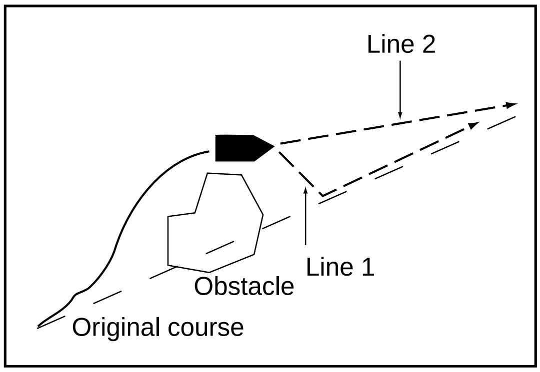
If you want to go directly to a route waypoint, place the cursor on the waypoint to show the flashing diamond, and then press the GO TO WPT soft key.

Navigate along specific leg of route

Place the cursor on the leg to display it in a white and red flashing line, and then press the FOLLOW LEG soft key.

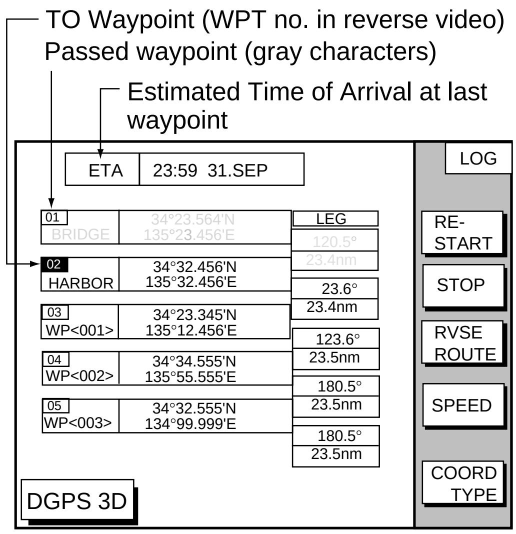
Restarting navigation

When you steer to avoid an obstacle or the vessel drifts, you may go back your intended course (Line 1 in the figure below). Use the steering or highway display to help you return to course.
Also, if you don't need to return to the original course, you can go directly to the waypoint (Line 2 in the figure below) using the restart function below.



Example of when to restart navigation

1. Set a destination.
2. Press the [WPT/RTE] key to open the WAYPOINT & ROUTE menu.
3. Press the LOG soft key.



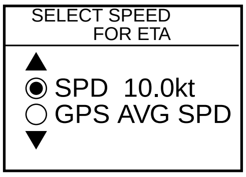
Log display

4. Press the RESTART soft key.

Setting speed for ETA calculation

Speed, which may be input manually or automatically, is required to calculate ETA (Estimated Time of Arrival) to a waypoint.

1. Press the [WPT/RTE] key to display the WAYPOINT & ROUTE menu.
2. Press the LOG soft key.
3. Press the SPEED soft key.



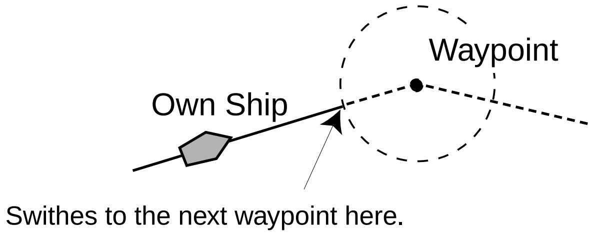
Select speed for ETA window

4. Key in speed manually in the SPD field, or use GPS speed data by selecting GPS AVG SPD.
5. Press the ENTER soft key to register your selection.

Switching waypoints

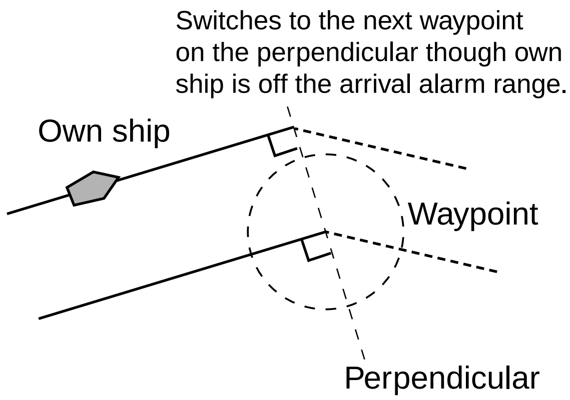
When you arrive to a waypoint on a route, you can switch to the next waypoint three ways: AUTO1, AUTO2 and MANUAL.

AUTO1: Automatically switches the TO waypoint when your boat is within the arrival alarm area. For how to set the arrival alarm area, see “9.3 Arrival Alarm” on page 9-2.



Auto 1

AUTO2: Automatically switches the TO waypoint when the boat enters the arrival alarm range or the boat passes an imaginary perpendicular line passing through the center of the destination waypoint.

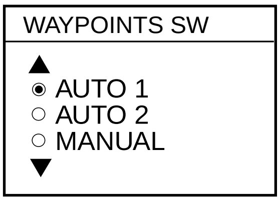


Auto 2

MANUAL: When the boat enters the arrival alarm area, the TO waypoint may be switched by using the RESTART soft key (on the LOG display). If the arrival alarm is not set, the waypoint will not be switched. To be alerted when you arrive at a waypoint turn on the audio alarm. For further details, see “9.2 Audio Alarm On/Off” on page 9-1.

To select waypoint switching method do the following:

1. Press the [MENU] key.
2. Press the DISPLAY OPTIONS soft key.
3. Select WAYPOINTS SW.
4. Press the EDIT soft key to show the waypoint sw window.



Waypoint sw window

5. Select appropriate waypoint switching method.
6. Press the ENTER soft key to close the window.

7.5 Canceling Navigation

1. Press the [WPT/RTE] key.
2. Press the LOG soft key.
3. Press the STOP soft key.
4. Press the [ENTER] key to go stand by.
5. Press the RELEASE soft key.
6. Press the [ENTER] key.

8. PLOTTER ALARMS

8.1 Introduction

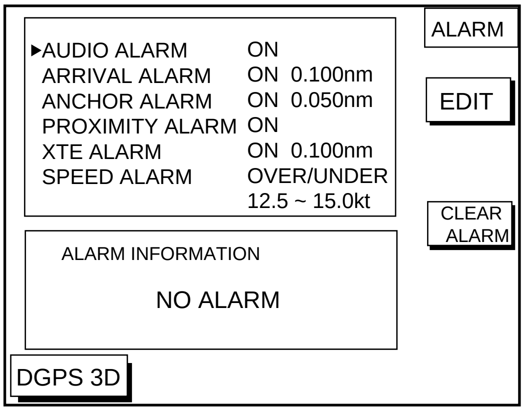
There are five plotter-related alarms which generate both audible and visual alarms: Arrival alarm, Anchor Watch alarm, XTE (Cross Track Error) alarm, Proximity alarm, and Speed alarm.

When an alarm setting is violated the buzzer sounds, and the speaker icon ( ) appears in red. You may silence the alarm by pressing the [CLEAR] key. The icon remains on the screen until the cause of the alarm is removed or the alarm is deactivated.

8.2 Audio Alarm On/Off

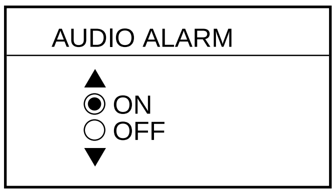
The audio alarm sounds whenever an alarm setting is violated. You can enable or disable the audio alarm as follows:

1. Press the [ALARM] key to show the ALARM menu.



Alarm menu

2. Press ▲ or ▼ to select AUDIO ALARM.
3. Press the EDIT soft key to show the audio alarm window.

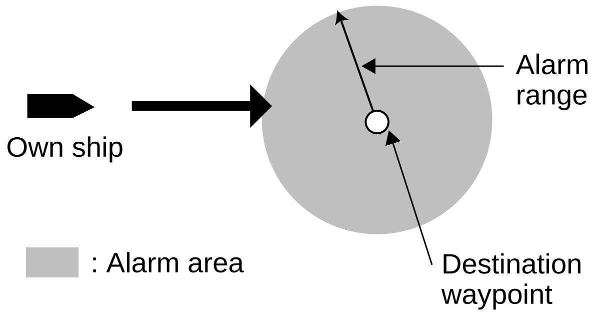


Audio alarm window

4. Press ▲ or ▼ to select ON or OFF.
5. Press the ENTER soft key or the [ENTER] key to register your selection.

8.3 Arrival Alarm

The arrival alarm informs you that your boat is approaching a destination waypoint. The area that defines an arrival zone is that of a circle which you approach from the outside of the circle. The alarm will be released if your boat enters the circle. When the arrival alarm is active, a red dashed circle marks the arrival alarm area.



How the arrival alarm works

1. Press the [ALARM] key to open the alarm menu.
2. Press ▲ or ▼ to select ARRIVAL ALARM.
3. Press the EDIT soft key to show the arrival alarm window.

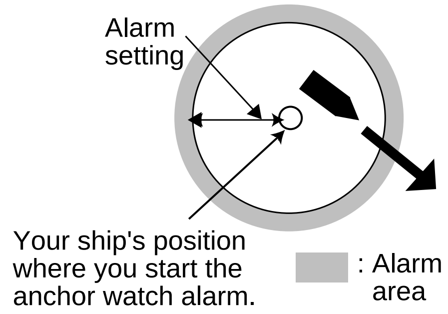
ARRIVAL ALARM
▲
◉ ON   0.500nm
○ OFF
▼

Arrival alarm window

4. Press ▲ to select ON.
5. Operate the cursor pad to place the cursor on the digit desired.
6. Key in the alarm range desired. The arrival alarm range is 0.001 to 9.999 miles.
7. Press the ENTER soft key or the [ENTER] key.

8.4 Anchor Watch Alarm

The anchor watch alarm informs you that your boat is moving when it should be at rest. When the anchor watch is active, a red dashed circle marks the anchor watch area.



How the anchor watch alarm works

1. Press the [ALARM] key to open the alarm menu.
2. Press ▲ or ▼ to select ANCHOR ALARM.
3. Press the EDIT soft key to open the anchor alarm window.

ANCHOR ALARM
▲
◉ ON   0.050nm
○ OFF
▼

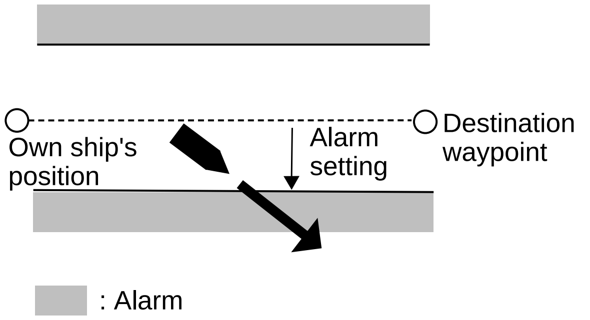
Anchor watch alarm window

4. Press ▲ to select ON.
5. Key in the alarm range desired. The anchor watch range is 0.001 to 9.999 miles.
6. Press the ENTER soft key or the [ENTER] key to register your selection.

The anchor alarm range appears with the circle, its center is the own ship location when pressing the [ENTER] key. If own ship goes out this range, the alarm works.

8.5 XTE (Cross Track Error) Alarm

The XTE alarm warns you when your boat is off its intended course. When the XTE alarm is active, two red dashed lines mark the XTE alarm area.



How the XTE alarm works

1. Press the [ALARM] key to open the alarm menu.
2. Press ▲ or ▼ to select XTE ALARM.
3. Press the EDIT soft key to open the XTE alarm window.

```
XTE ALARM
▲
◉ ON   0.100nm
○ OFF
▼
```

XTE alarm window

4. Press ▲ to select ON.
5. Key in the alarm range desired. The XTE alarm range is 0.001 to 9.999 miles.
6. Press the ENTER soft key or the [ENTER] key to register your selection.

8.6 Speed Alarm

The speed alarm warns you when your boat’s speed is within, over/under or under the speed range set.

1. Press the [ALARM] key to open the alarm menu.
2. Press ▲ or ▼ to select SPEED ALARM.
3. Press the EDIT soft key to display the speed alarm window.

```
SPEED ALARM
▲
◉ WITHIN     15.0 ~ 15.3
○ OVER/UNDER          kt
○ OFF
▼
```

Speed alarm window

4. Press ▲ or ▼ to select WITHIN or OVER/UNDER.
5. Key in the alarm range desired.
6. Press the ENTER soft key or the [ENTER] key to finish.

8.7 Proximity Alarm

The proximity alarm alerts you when your vessel nears a waypoint by the distance set for that waypoint on the waypoint list. This distance is called the proximity alarm radius. The waypoint having a proximity alarm radius is displayed with ⊘. You can globally activate or deactivate the proximity alarm here.

1. Press the [ALARM] key to open the alarm menu.
2. Press ▲ or ▼ to select PROXIMITY ALARM.
3. Press the EDIT soft key to show the proximity alarm window.

```
PROXIMITY ALARM
▲
◉ ON
○ OFF
▼
```

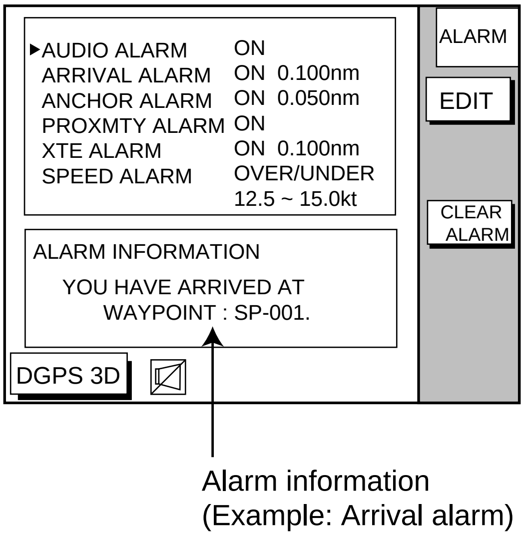
Proximity alarm window

4. Select ON or OFF by the cursor pad.
5. Press the ENTER soft key or the [ENTER] key to register your selection.

8.8 Alarm Information

When an alarm setting has been violated the buzzer sounds and the speaker icon (shown in red) appears. You can see which alarm has been violated, as well as silence the buzzer, on the alarm menu display.

1. Press the [ALARM] key.



Alarm menu

2. Press the CLEAR ALARM soft key to silence the buzzer. The color of the alarm message and the speaker icon changes from red to black.

Note: The speaker icon is displayed in red until all alarms have been acknowledged on the alarm menu display. If more than one alarm has been violated the message CONTINUE appears at the bottom of the display. In this case press the NEXT INFO soft key to see which other alarms have been violated.

Alarm messages

Alarm messages and their meanings

Message	Meaning
YOU HAVE ARRIVED AT WAYPOINT.	Arrival alarm setting violated.
YOU HAVE EXCEEDED ANCHOR WATCH LIMIT.	Anchor watch alarm setting violated.
YOU HAVE ENTERED AN AVOIDANCE AREA.	Proximity alarm setting violated.
YOU HAVE EXCEEDED XTE LIMIT.	XTE alarm setting violated.
YOU HAVE EXCEEDED SPEED ALARM LIMIT.	Speed alarm setting violated.

9. MEMORY CARD OPERATIONS

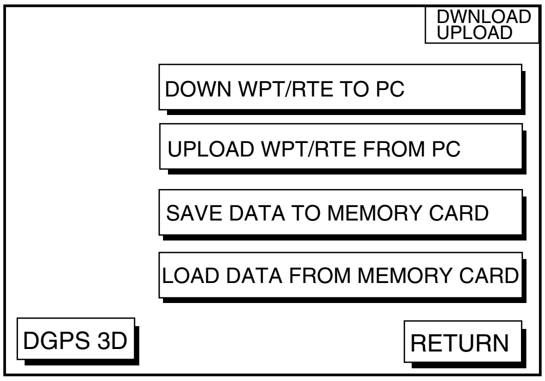
The following data can be saved to memory cards:

- Mark/line
- Waypoints/routes
- Track
- Configuration (menu settings)

9.1 Formatting Memory Cards

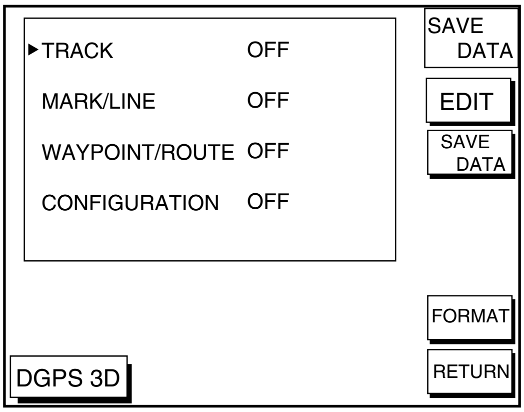
Before you can use a memory card it must be formatted. Note that formatting a used card erases all saved data.

1. Turn the power off.
2. Insert the memory card you want to format into the slot.
3. Turn the power on.
4. Press the [MENU] key followed by the CONFIGURATION and UPLOAD/DOWNLOAD DATA soft keys.



Download/upload menu

5. Press the SAVE DATA TO MEMORY CARD



Save data display

6. Press the FORMAT soft keys. You are asked if you are ready to format the memory card.

7. Press the [ENTER] key to format (or press the [CLEAR] key to escape). Now FORMATTING MEMORY CARD appears. Do not remove the card while it is being formatting. When the formatting is completed, FORMAT COMPLETED appears.
8. Press the [ENTER] key to finish. Now you can record data to the memory card.

Note: Chart cards cannot be formatted.

9.2 Saving Data to Memory Card

The memory card can save four items of data; track, mark/line, waypoint/route and configuration.

Saving data

1. Insert a formatted memory card into the slot.
2. Press the [MENU] key followed by the CONFIGURATION and UPLOAD/DOWNLOAD DATA soft keys.
3. Press the SAVE DATA TO MEMORY CARD soft key. The SAVE DATA display appears.
4. Press ▲ or ▼ to select item to save.
5. Press the EDIT soft key to open the TRACK, MARK/LINE, WAYPOINTS/ROUTES or CONFIGURATION window.
6. Press ▲ to select ON.
7. Press the ENTER soft key or the [ENTER] key.
8. Repeat steps 4 to 7 to save other data if desired.
9. Press the SAVE DATA soft key. The following message appears and saving starts. Do not remove the memory card while data is being saved.

   NOW SAVING DATA TO
   MEMORY CARD. DO NOT
   TURN OFF THE POWER UNTIL
   SAVING COMPLETED.

   SAVE DATA message

   When saving is completed, COMPLETE SAVING DATA appears.
10. Press the [ENTER] key.

Error messages

Memory card not inserted

Press the [ENTER] key to return to the SAVE DATA display.

MEMORY CARD NOT
INSERTED. INSERT CARD
PRESS "ENTER" key
TO CONTINUE.

Not inserted message

Unformatted memory card

Press the [ENTER] key to return to the SAVE DATA display. And format it refering to the previous page.

MEMORY CARD NOT
FORMATTED
PRESS "ENTER" key
TO CONTINUE.

Not formatted message

Wrong card inserted

When a wrong card is inserted, the following error message appears. Press the [ENTER] key to return to the SAVE DATA display. Replace it with a formatted memory card.

WRONG CARD INSERTED.
INSERT MEMORY CARD.
PRESS "ENTER" key
TO CONTINUE.

Wrong card message

Data overwrite

Data type to be recorded exists on memory card. (Two or more of same data type cannot be recorded.) Press the [ENTER] key to overwrite same data type on the card, or press the [CLEAR] key to escape.

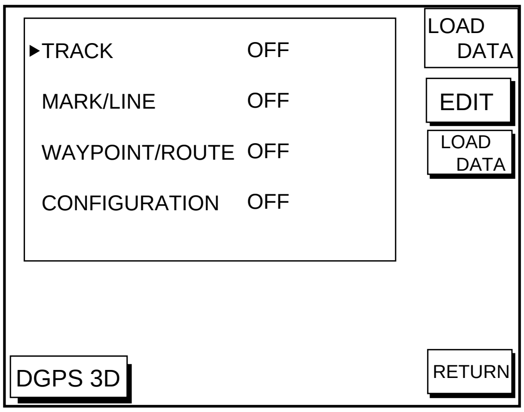
OVERWRITE FOLLOWING
DATA. OK?
(TRACK)
YES ... "ENTER" key
NO ... "CLEAR" key

Overwrite message

9.3 Loading Data from Memory Card

Data (track, marks, waypoints, configuration) can be loaded from a memory card and displayed on the screen. This feature is useful for observing past data and setting up the equipment for a specific purpose (with “configuration”).

1. Press the [MENU] key followed by the soft keys CONFIGURATION and UPLOAD/DOWNLOAD DATA.
2. Press the LOAD DATA FROM MEMORY CARD soft key to show the LOAD DATA display.



Load data display

3. Press ▲ or ▼ to select item to load.
4. Press the EDIT soft key to show the ON/OFF selection window.
5. Press ▲ to select ON. Press the ENTER soft key or the [ENTER] key. If the memory card does not contain the item selected, the buzzer sounds and ON cannot be selected.
6. After you select all items desired, press the LOAD DATA soft key to load data. The following message appears.

NOW LOADING DATA FROM MEMORY CARD. DO NOT TURN OFF THE POWER UNTIL LOADING COMPLETE.

Load data message

After loading is completed, the following message appears.

COMPLETE LOADING DATA. PRESS "ENTER" KEY TO CONTINUE.

Complete message

7. Press the [ENTER] key.

Notes on loading data

Track

Since loaded track data is added to internal track, oldest track in the memory of the unit will be deleted when the track memory capacity is exceeded.

Waypoint/route

Waypoints/routes in the memory of the unit are deleted to make room for loaded ones.

Mark/line

The loaded data is added to internal data. When the mark/line memory becomes full, no marks may be entered.

Configuration

The loaded data replaces current configuration settings. Press the [ENTER] key to restart. If the memory card is ejected while loading, or data could not be loaded, press the [ENTER] key to restart with default settings. Note that the track memory capacity setting is not saved nor loaded.

10. CUSTOMIZING YOUR UNIT

This section describes the various options which allow you to set up your unit to suit your needs.

10.1 CHART SETUP OPTIONS menu

The chart offset options menu provides three menus: chart offset, track control, and chart details.

1. Press the [MENU] key to open the main menu.
2. Press the CHART SETUP OPTIONS soft key.

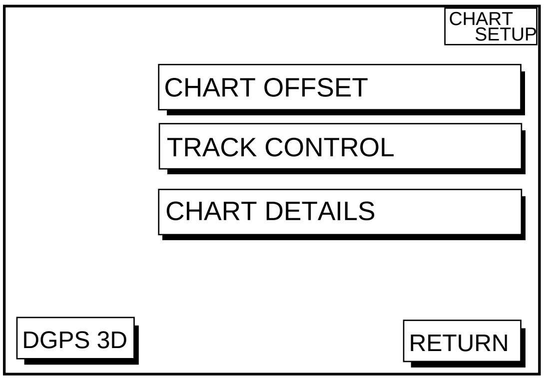
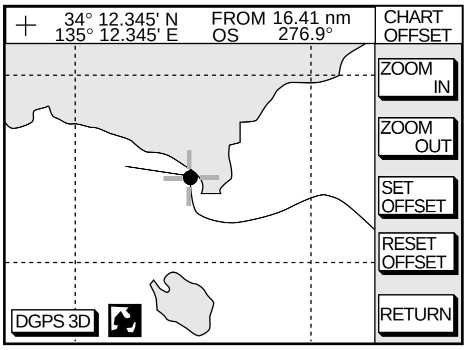


Chart setup options menu

CHART OFFSET menu

In some instances position may be off by a few minutes. For example, the position of the ship is shown to be at sea while it is in fact moored at a pier. You can compensate for this error by offsetting chart position as follows:

1. Press the [MENU] key followed by the CHART SETUP OPTIONS and CHART OFFSET soft keys.



Plotter display, chart offset selected

2. Use the cursor pad to place the cursor where to offset chart position.
3. Press the SET OFFSET soft key.
4. Press the RETURN soft key to finish.

To cancel chart offset, press the RESET OFFSET soft key at step 3 in the above procedure.

TRACK CONTROL menu

This menu mainly controls track color and track plotting interval. For further details see Chapter 3.

CHART DETAILS menu

1. Press the [MENU] key followed by the CHART SETUP OPTIONS and CHART DETAILS soft keys.

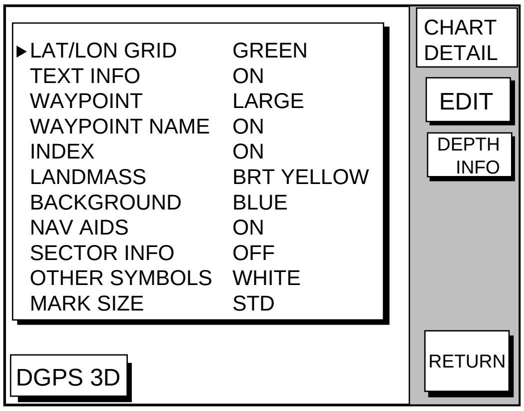


Chart details menu

2. Use the cursor pad to select item and press the EDIT soft key.
3. Select option with the cursor pad and press the RETURN soft key to finish.

Chart details menu description

LAT/LONG GRID: Turns lat/long grid on/off and changes its color.

TEXT INFO: Turns geographic name display on/off.

WAYPOINT: Turns waypoint on or off and selects size to large or small. “LARGE” displays waypoint in shape selected; “SMALL” shows waypoints as an X regardless of actual shape. “OFF” only display waypoints when they are used in navigation.

WAYPOINT NAME: Turns waypoint name on/off.

INDEX: Turns chart indices on/off.

LANDMASS: Selects brightness and color of land.

BACKGROUND: Selects background color to black or blue.

NAV AIDS: Turns aids to navigation symbols (for example, buoys) on/off. When OFF is selected, symbols are displayed but information is not.

SECTOR INFO: Turns lighthouse viewable angle indication (on FURUNO charts) on/off. Viewing angle is shown as an arc extending from lighthouse position. Arc color, white or green, is the color of the light beam. This feature is available with selected charts.

OTHER SYMBOLS: Selects color of all other chart symbols.

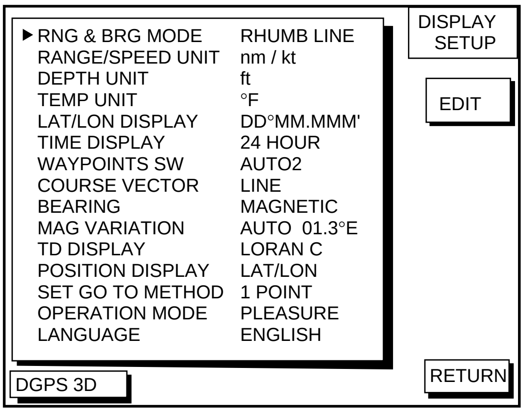
MARK SIZE: Selects the mark size STD (standard) or SMALL (appearing with “x”.)

DEPTH INFO soft key: Turns depth info display on/off and sets it color.

10.2 DISPLAY OPTIONS menu

This menu contains items for setting up the plotter displays.

1. Press the [MENU] key.
2. Press the DISPLAY OPTIONS soft key. The display setup1 menu appears.



Display setup menu

DISPLAY SETUP menu description

RNG & BRG MODE

The GPS receiver calculates the range, bearing, cross track error (XTE) and ETA to TO waypoint when you set a destination. The range and bearing can be calculated by GREAT CIRCLE (straight line between two points) or RHUMB LINE (straight line between two points on nautical chart) method.

RANGE/SPEED UNIT

Selects the unit for range and speed; nm/kt, km/ km/h, sm/ sm/h.

DEPTH UNIT

Selects unit of depth measurement among feet, fathoms, and meters.

TEMP UNIT

Selects unit of water temperature measurement between Celsius and Fahrenheit.

LAT/LON DISPLAY

Displays the minutes of latitude and longitude positions in hundredths, thousandths or ten thousandths.

TIME DISPLAY

Selects time display format for 12 hour or 24 hour.

WAYPOINT SW

Provides automatic or manual waypoint switching when following a route. For further details, see page 7-5.

COURSE VECTOR

You may extend a line from the own ship position to show ship's course. The line can be a vector (the length depends on the ship's speed) or course bar (course bar).

BEARING

A navigation device outputs both true and magnetic bearings. A magnetic bearing is true bearing plus (or minus) earth's magnetic deviation. Thus the equation for finding magnetic bearing is;

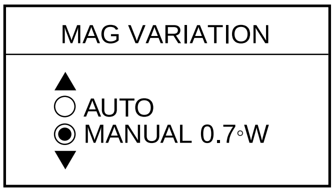
true bearing ±x (magnetic variation)° = magnetic bearing

You can display your ship's course and bearing to waypoint in true or magnetic bearing.

MAG VARIATION

The magnetic variations for all areas of the earth are preprogrammed into this unit. The preprogrammed variation is accurate for most instances, however you may wish to manually enter a updated variation referring the latest navigation chart.

1. Select MAG VARIATION, and press the EDIT soft key to show the mag variation window.



Mag variation window

2. Select MANUAL.
3. Key in magnetic deviation value.
4. Press the W<-->E soft key to switch between East and West and vice versa, if necessary.
5. Press the ENTER soft key or the [ENTER] key to finish.

TD DISPLAY

Position may be shown in Loran C TDs, Decca TDs, or latitude and longitude. To display position in TDs, select Loran C or Decca here and choose TD at “POSITION DISPLAY” below. You can select the Loran C or Decca chain to use on the TD SETUP menu. For details see “TD SETUP menu” on page 10-7 and 8.

POSITION DISPLAY

Displays position in latitude and longitude or TD (time difference).

SET GO TO METHOD

Selects the method for entering the quick point: 1 POINT, 35 POINT (2-35 points), or WPT/PORT SER. For further details see pages 7-1 and 7-2.

OPERATION MODE

Selects the operation mode among PLEASURE, FISHING 1 and FISHING 2. For details, see page 4-1 and 5-1.

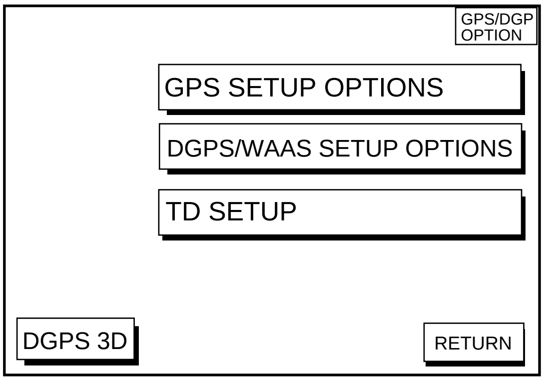
LANGUAGE

Selects the language for operation display for ENGLISH or FRENCH.

10.3 GPS/DGPS/TD OPTIONS menu

This menu sets up GPS and DPGS receivers and enables display of position in Loran C or Decca TDs.

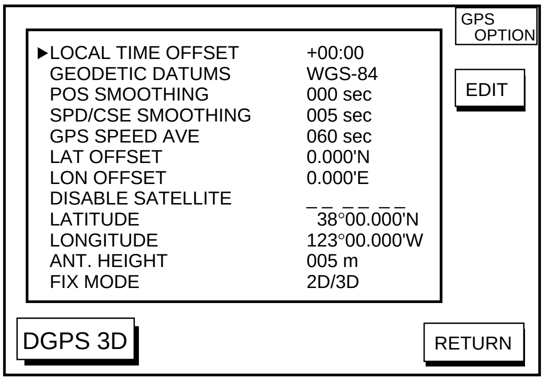
1. Press the [MENU] key.
2. Press the GPS/DGPS/TD OPTIONS soft key to display the GPS/DGPS/TD options menu.



GPS/DGPS/TD options menu

GPS SETUP OPTIONS menu description

This menu provides items for setting up the GPS receiver. To display it, display the menu shown above, and then press the GPS SETUP OPTIONS soft key.



GPS SETUP options menu

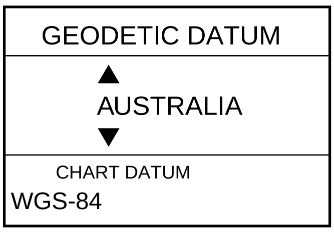
LOCAL TIME OFFSET

GPS uses UTC time. If you would rather use local time, enter the time difference between it and UTC time. Use the +<-->- soft key to switch from plus to minus and vice versa.

GEODETIC DATUM

Your equipment is preprogrammed with most of the major chart systems of the world. Although the WGS-84 system, the GPS standard, is now widely used other categories of charts still exist. Select the chart system used, not the area where your boat is sailing. The default chart system is WGS-84.

1. Select GEODETIC DATUM.
2. Press the EDIT soft key to show the geodetic datum window.



Geodetic datum window

3. Press ▲ or ▼ to select the chart system you are using. If UNKNOWN appears in the GEODETIC DATUM window, select a different chart system.
4. Press the ENTER soft key or the [ENTER] key to register your selection.

POS SMOOTHING

When the DOP or receiving condition is unfavorable, the GPS fix may change, even if the vessel is dead in water. This change can be reduced by smoothing the raw GPS fixes. A setting between 000 to 999 is available. The higher the setting, the more smoothed the raw data, however too high a setting slows response time to change in latitude and longitude. This is especially noticeable at high ship's speeds. 000 is the normal setting; increase the setting if the GPS fix changes.

SPD/CSE SMOOTHING

During position fixing, ship's velocity (speed and course) is directly measured by receiving GPS satellite signals. The raw velocity data may change randomly depending on receiving conditions and other factors. You can reduce this random variation by increasing the smoothing. Like with latitude and longitude smoothing, the higher the speed and course smoothing the more smoothed the raw data. If the setting is too high, however, the response to speed and course change slows. For no smoothing, enter all zeroes. The default setting is 005 (sec).

GPS SPEED AVE

Calculation of ETA is based on average ship's speed over a given period. If the period is too long or too short calculation error will result. Change this setting if calculation error occurs. The default setting is 60 seconds, which is suitable for most conditions.

LAT OFFSET, LON OFFSET

GPS-generated position may be off from the chart. In this case, you can apply an offset to GPS position to refine position accuracy. Mark the equipment indication on the chart, and then calculate the L/L error.

1. Select LAT OFFSET or LON OFFSET.
2. Press the EDIT soft key.
3. Key in the error value. To switch the north and south (east and west), press the N<->S (W<->E) soft key.
4. Press the ENTER soft key or [ENTER] key.

DISABLE SATELLITE

Every GPS satellite is broadcasting abnormal satellite number(s) in its Almanac, which contains general orbital data about all GPS satellites, including those which are malfunctioning. Using this information, the GPS receiver automatically eliminates any malfunctioning satellite from the GPS satellite schedule. However, the Almanac sometimes may not contain this information. If you hear about a malfunctioning satellite from another source, you can disable it manually. Enter satellite number (max. 3 satellites) in two digits and press the ENTER soft key or the [ENTER] key.

LATITUDE, LONGITUDE

The default latitude and longitude position is San Francisco, USA (38.00.000'N, 123.00.000'W). When the unit is turned on for the first time it begins searching for its actual position. To lessen the time required to find position, you may enter your position manually. To switch from North to South and vice versa, use the N<-->S soft key, and to switch from West to East and vice versa, use the W<-->E soft key. Finally, press the ENTER soft key or the [ENTER] key.

ANT. HEIGHT

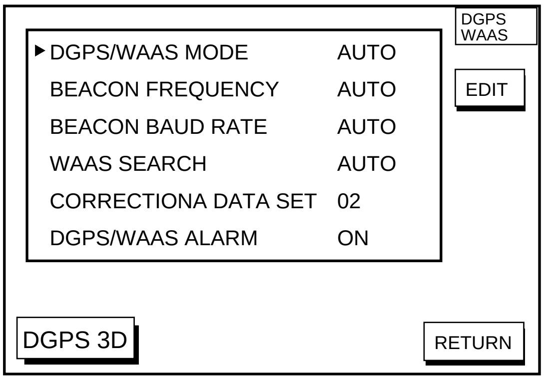
Enter the height of the antenna unit above sea surface. For further details refer to the Installation Manual.

FIX MODE

You can choose the position-fixing mode from 2D or 2D/3D. 2D requires three satellites to fix position; 2D/3D requires three or four satellites, whichever is available.

DGPS/WAAS SETUP OPTIONS menu

This menu sets parameters for the DGPS beacon receiver. (GP1650WD, or GP1650W equipped with DGPS beacon receiver.) and WAAS. To display it, press the [MENU] key followed by the GPS/DPGS/TD OPTIONS and DGPS SETUP OPTIONS soft keys.



DGPS/WAAS menu

DGPS/WAAS MODE

Select DGPS, WAAS or AUTO. (Position is fixed by WAAS when DGPS correction data is not available.)

BEACON FREQUENCY (for DGPS)

DGPS reference station can be searched automatically or manually. For manual

search, select MANUAL here, and use the cursor pad to select frequency of DGPS reference station. The default setting is AUTO.

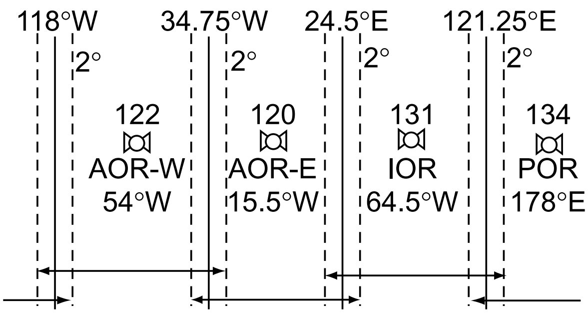
BEACON BAUD RATE (for DGPS)

Selects the transmission rate of the DGPS reference station nearest you, among AUTO (default setting), 50, 100 or 200 bps. This setting is only effective when DGPS mode is "manual"; baud rate cannot be changed in automatic DGPS mode.

WAAS SEARCH (for WAAS)

Choose AUTO for automatic search or MANUAL for manual search. For MANUAL, enter appropriate WAAS satellite number, referring to the illustration below.

AUTO mode and GEO satellite (in JUNE 2002)



One-degree threshold

Longitude Range	Satellite
120.25°E to 117°W	134
119°W to 33.75°W	122
35.75°W to 25.5°E	120
23.5°E to 122.25°E	131

CORRECTIONS DATA SET (for WAAS)

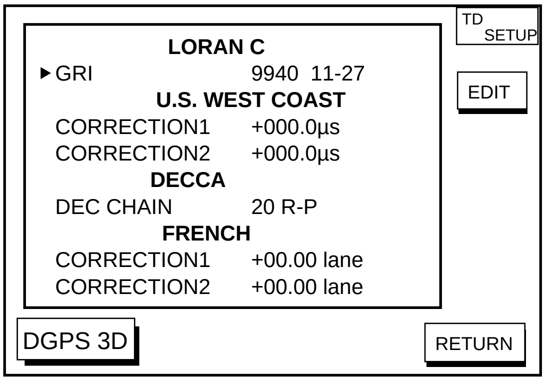
Determines how to use the WAAS signal, currently in the test mode. Enter appropriate two-digit numeric. Use "02" (default setting) until the WAAS System changes from its current "Testing Status" to "Operational Status".

DGPS/WAAS ALARM

This alarm alerts you by aural and visual alarms when the WAAS/DGPS signal is lost.

TD SETUP menu

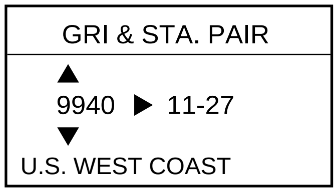
This menu selects the Loran C or Decca chain to use to display position in TDs. To display it, press the [MENU] key followed by the GPS/DPGS/TD OPTIONS and TD SETUP soft keys.



TD setup menu

Displaying LORAN C TDs

1. Select GRI and press the EDIT soft key to show the GRI & STA. PAIR window.

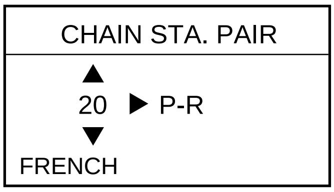


GRI & sta. pair window

2. Press ▲ or ▼ to select GRI code. Press ► to enable selection of station pair, and then press ▲ or ▼ to select station pair. See the Loran C chain list at the end of this manual for GRI and station pairs.
3. Press the ENTER soft key or the [ENTER] key to register your selection.
4. If necessary, you may enter a position offset to refine Loran C position. Select LORAN C CORRECTION1 or CORRECTION2 and press the EDIT soft key. Enter correction value and press the ENTER soft key or the [ENTER] key. Use the + <--> - soft key to switch from plus to minus and vice versa.

Displaying DECCA TDs

1. Select DEC CHAIN and press the EDIT soft key to show the chain sta. pair window.



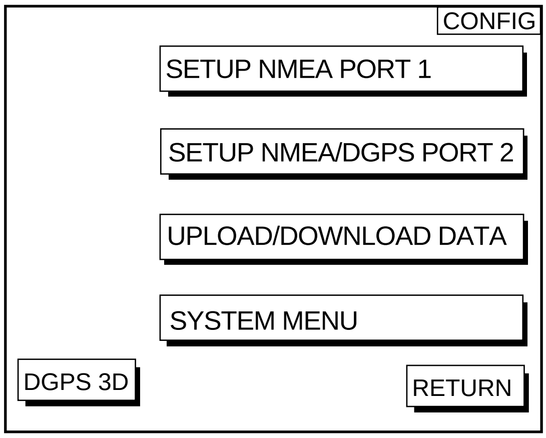
Chain sta. pair window

2. Press ▲ or ▼ to select Decca chain number. Press ► to enable selection of lane, and then press ▲ or ▼ to select lane pair (R: red, G: green and P: purple). Refer to the Decca chain list at the end of this manual.
3. Press the ENTER soft key or the [ENTER] key to register your selection.
4. If necessary, you may enter position offset to refine Decca position. Select DECCA CORRECTION1 or CORRECTION2 and press the EDIT soft key. Enter correction value and press the ENTER soft key or the [ENTER] key. Use the + <--> - soft key to switch from plus to minus and vice versa.

10.4 CONFIGURATION menu

The CONFIGURATION menu has facilities for setting up data ports, uploading/downloading data, diagnostic test, demonstration mode setup, and memory clearing.

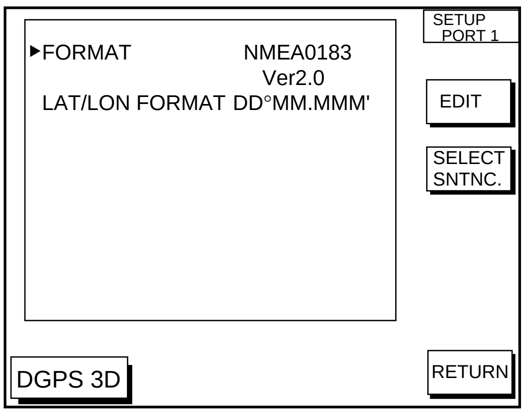
1. Press the [MENU] key.
2. Press the CONFIGURATION soft key to display the configuration menu.



Configuration menu

SETUP NMEA PORT 1 menu description

This menu sets up DATA PORT 1 according to the specifications of the equipment connected to it. The menu can be displayed by pressing the [MENU] key followed by the CONFIGURATION and SETUP NMEA PORT 1 soft key. For detailed information, see the Installation Manual.



Setup NMEA port 1 (or 2) menu

FORMAT

Selects NMEA0183 version 1.5 or 2.0. If you are unsure of the version number, try both equipment and choose the one which outputs data correctly.

LAT/LON FORMAT (GGA only)

Selects the minute of latitude and longitude positions in hundredths, thousandths or ten thousandths.

SELECT SNTNC. soft key

This key enables/disables input/output of data sentences.

SETUP NMEA/DGPS PORT 2 menu description

This menu should be set according to the specifications of the equipment connected to connectors PORT 2 (DGPS) at the rear of the display unit. The menu can be displayed by pressing the [MENU] key followed by the CONFIGURATION and SETUP NMEA PORT 2 soft keys. For detailed information, see the Installation Manual.

FORMAT

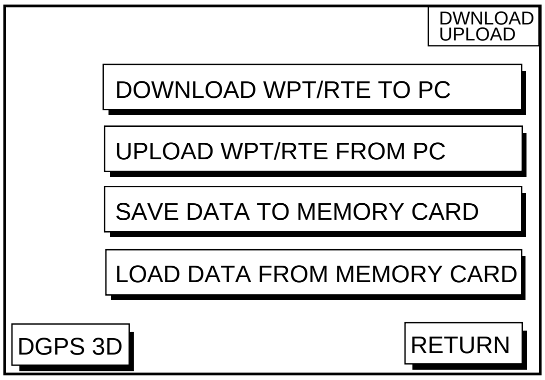
Selects data format of connected equipment; NMEA0183 version 1.5, version 2.0, RTCM104 (EXTRN), RTCM104 (INTRN) or RTCM104 (OUTPUT). RTCM104 (INTRN) or RTCM104 (OUTPUT) is for GP-1650WD only.

LAT/LON FORMAT (GGA only)

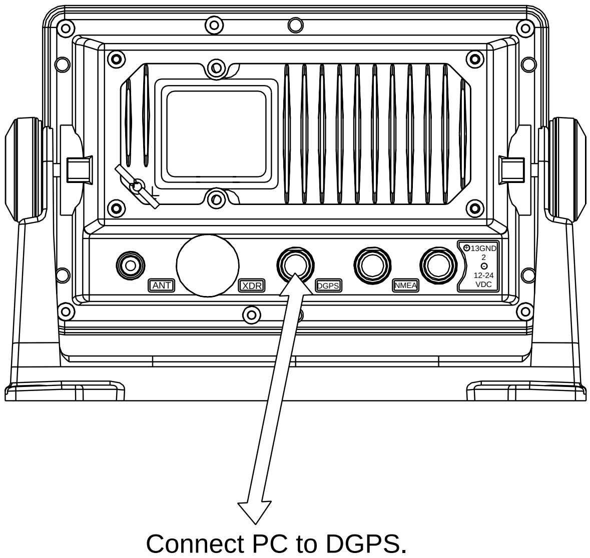
This setting can be performed when NMEA0183 Ver.1.5 or 2.0 is minute as the FORMAT. It displays the seconds of latitude and longitude positions in hundredths, thousandths or ten thousandths.

UPLOAD/DOWNLOAD DATA menu

This menu allows you to upload waypoint and route data to a PC or download the same data from a PC, via the DGPS connector at the back of display unit. The menu can be displayed by pressing the [MENU] key followed by the CONFIGURATION and UPLOAD/DOWNLOAD DATA soft keys. For detailed information, see the Installation Manual.



Upload/download menu



Display unit, rear view

Set communication software on the PC as follows:

Baud Rate:	4800 bps
Character Length:	8 bit
Stop bit:	1 bit
Parity:	None
X Control:	XON/XOFF

The following data can be downloaded/uploaded between a personal computer and this equipment:

- Waypoint data (In alphanumeric order)

- Route data (In order of route number)
- End of sentence

Note 1: There are two kinds of data for route data: route data and route comment data.
Note 2: DGPS position fix is not available when uploading or downloading data.

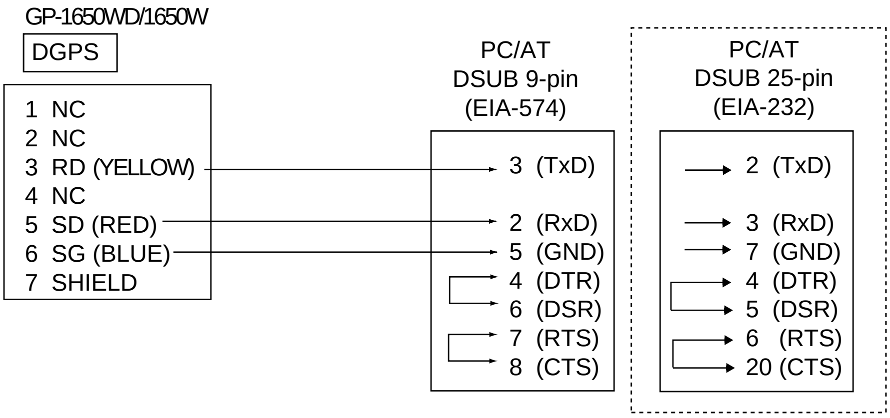
Download waypoint/route to PC

1. Connect the PC to the GP-1650W series as shown on the next page.
2. Press the DOWNLOAD WPT/RTE TO PC soft key. You are asked if you are ready to download waypoints and routes.
3. Press the [ENTER] key to download.

Upload waypoint/route from PC

Note that all waypoint and route data stored in this unit will be deleted when data is uploaded.

1. Connect the PC to the GP-1650W series as shown below.
2. Press the UPLOAD WPT/RTE FROM PC soft key. You are asked if you are ready to upload waypoints and routes.
3. Press the [ENTER] key to upload.



Connection of GP-1650WD/GP-1650W to PC

Waypoint data format

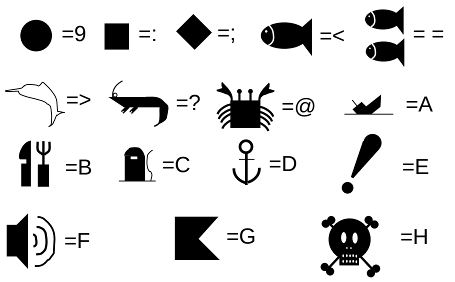
```
PFEC, GPwpl, llll.lll, a, yyyyy.yyy, a, c----c, c, c----c, A <CR><LF>
                1      2      3      4     5    6     7    8
```

Waypoint data format

1: Waypoint latitude
2: N/S
3: Waypoint longitude
4: E/W
5: Waypoint name (Number of characters is fixed to 6 and space code is placed when the number of characters are less than 6.)
6: Waypoint color
7: Waypoint comment (1 byte for mark code + 13 characters of comment.)
   1st byte of mark code: Fixed to '@'.
   2nd byte of mark code: Internal mark code. See Note 1.
8. Information of marking waypoint. Always set to "A".
   "A": Displayed
   "V": Not displayed

Note 1: Following characters can be used for comments:

_ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789&'#



Character available for comment

Route data menu

```
$GPRTE, x, x, a, ccc, c----c, c----c, ... , c----c <CR><LF>
        1  2  3   4     5       6              12
```

Route data format

1: Number of sentences required for one complete route data (1 to 4). See Note 2.
2: Number of sentences currently used (1 to 4)
3: Message mode (Always set to C)
4: Route No. (001 to 300, 3 digits required)
5 through 12: Waypoint name (Max. 8 names, length of each waypoint name is fixed to 7 byte)

Note 2: A route can may contain 35 waypoints and GPRTE sentence for one route data may exceed 80 byte limitation. In this case, route data is divided into several GPRTE sentences (Max. 4 sentences). This value shows the number of sentences the route data has been divided.

Route comment data format

```
$PFEC, GPrtc, xx, c----c <CR><LF>
              1     2
```

Route comment format

1: Route No. (01 to 200, 3 digits required)
2: Route comment (Max. 16 characters, variable length)

The same characters of the comment for waypoint comment can be used.

End of sentence

```
$PFEC, GPxfr, CTL, E <CR><LF>
```

End of sentence

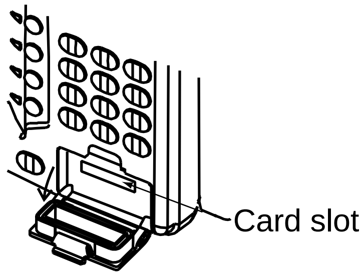
This page is intentionally left blank.

11. USING C-MAP NT MODEL

The GP-1650WD/1650W C-MAP NT series uses FURUNO mini chart cards and C-MAP NT-FP chart cards. These charts show accurate coastlines, depth contours, place names, aids to navigation such as buoys and lighthouses, and other navigational marks.

11.1 Inserting Chart Card

1. Push down the lid catch to open the chart card slot cover.



Location of chart card slot cover

2. Insert appropriate chart card groove side up.
3. Close the slot cover to protect the chart drive. (Keep the slot cover closed at all times.)

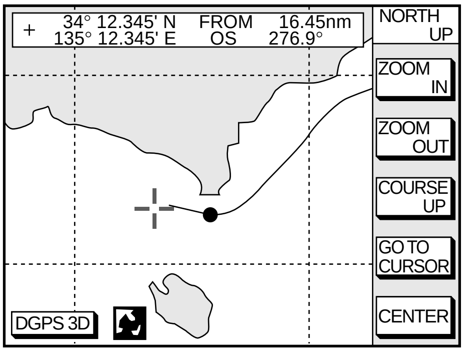
Note 1: Turn off the power before inserting or ejecting the chart card.

Note 2: When using C-MAP NT-FP card, do not eject it while a chart is being drawn. This may cause the equipment to stop working.

11.2 Cursor and Data Display

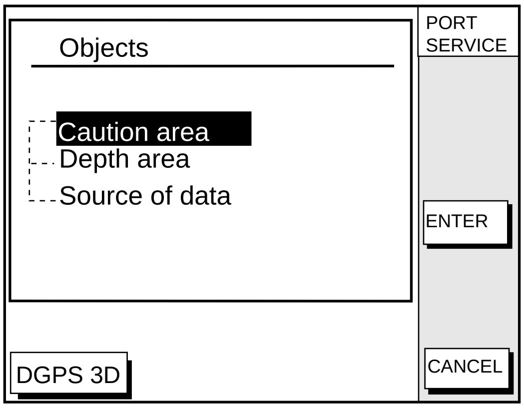
Besides its fundamental functions of providing position data, the cursor can also show caution area, depth area, source of data, etc. Further, you can display information about an icon by placing the cursor on it.

1. Press the cursor pad to turn the cursor on.



Plotter display

2. Use the cursor pad to place the cursor on the position desired.
3. Press the [ENTER] key to open the Objects window. For example the following window appears.



Objects window

4. Press ▲ or ▼ to select the item desired.
5. Press the ENTER soft key or the [ENTER] key to display details for object selected Objects.

Caution area

Information

LEUCHTFEUER DIE KARTE ENTHAEL T NUR DIE LAGEN DER WICHTIGEN FEUER. LIGHTS ONLY THE PRINC IPAL LIGHTS ARE SHOWN ON THIS CHART. MISSWEISUNG SIEHE K ARTEN GROESSEREN MASSSTABS. M AGNETIC VARIATION LOCAL MAGNE TIC ANOMALIES SEE LARGER SCAL E CHARTS.

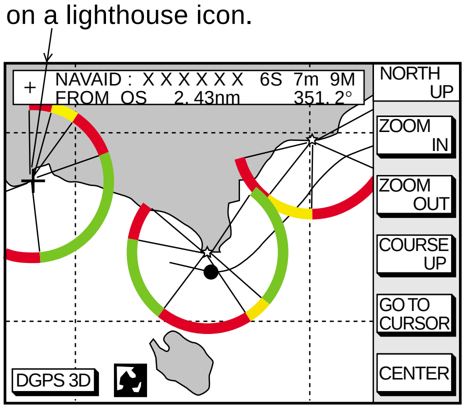
Example of caution area window

6. Press the CANCEL soft key to close the window.
7. Repeat steps 4 to 6 to select other item.
8. Press the CANCEL soft key to close the Objects window.

When you place the cursor on any icon, its information appears.

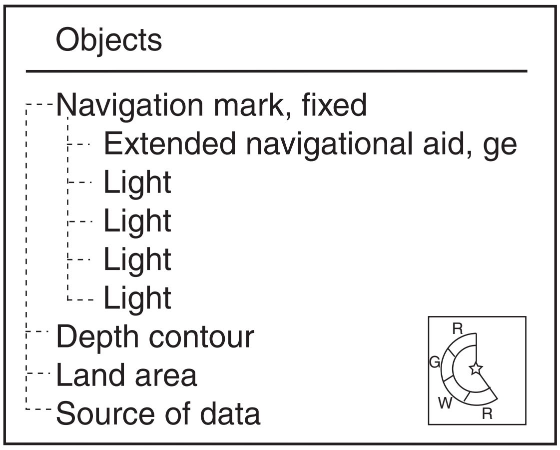
1. Place the cursor on a lighthouse icon.

Place the cursor
on a lighthouse icon.



Lighthouse icon

2. Press the [ENTER] key. For example, the following window appears.



Object windows

3. Press ▲ or ▼ to select the item desired.
4. Press the [ENTER] key to display detailed information.

Navigation mark, fixed
Light.

Color
white
Height
7. 00 Meters
Light characteristic
occulting
XXXXXXXX
XXXXXXXX

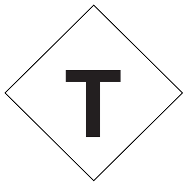
Sample lighthouse data

5. Press the CANCEL soft key to close the Objects window.

11.3 Tidal Information

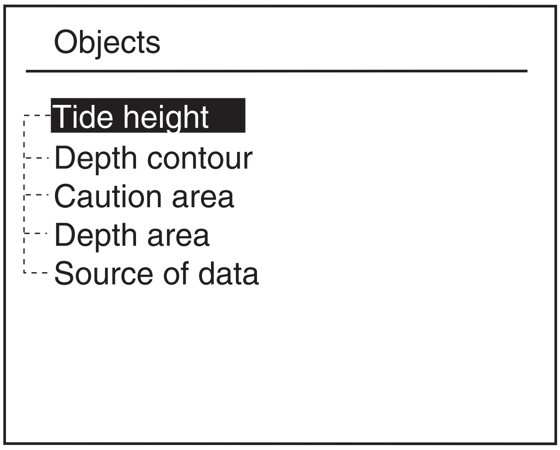
The C-MAP NT-FP chart card provides for calculation of the tide heights for any date. Additionally it displays the times of sunrise and sunset.

1. Press the cursor pad to place the cursor on a Tide icon.



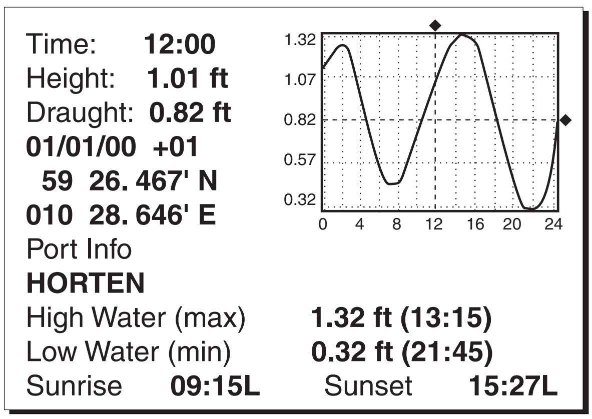
Tide icon

2. Press the [ENTER] key to open the Objects window.



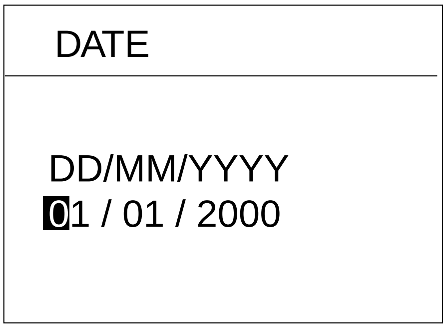
Objects window

3. Press ▲ or ▼ to select Tide height.
4. Press the ENTER soft key or the [ENTER] key to open the TIDE window.



TIDE window

5. Press the DATE soft key to open the DATE window.



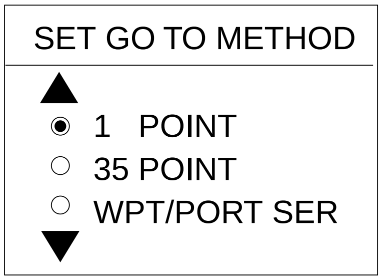
DATE window

6. Use ◄ or ► to position the cursor where desired and then press the appropriate numeric keys to enter a date.
7. Press the ENTER soft key or the [ENTER] key to show the tidal graph for entered date.
8. Press ◄ or ► to locate the vertical cursor on the time desired. Time and height are shown to the left of the graph.
9. Press ▲ or ▼ to shift the level cursor. Draught is shown to the left of the graph.
10. Press the CANCEL soft key to close the TIDE window.

11.4 Navigating to Ports, Port Services

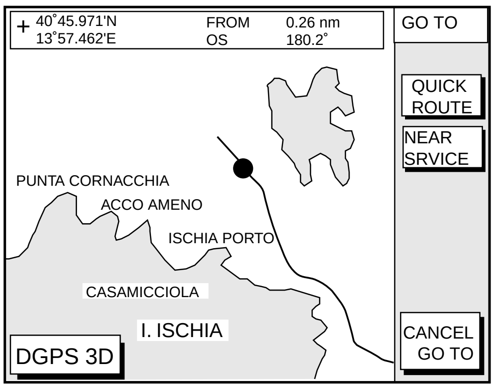
The C-MAP NT-FP chart provides detailed information on aids to navigation (buoy, lighthouse) and port service information. The port service information includes the availability of water and fuel supplies, shipyards, first aid, etc. You can use the list to set destination as follows:

1. Press the [MENU] key to open the main menu.
2. Press the DISPLAY OPTIONS soft key.
3. Press ▼ to select SET GO TO METHOD and press the EDIT soft key. The SET GO TO METHOD window appears.



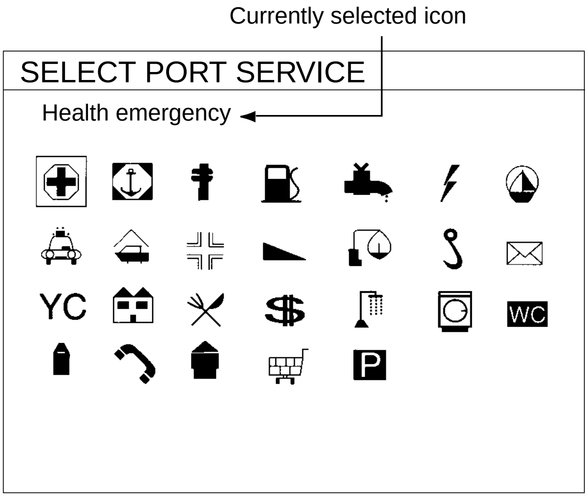
SET GO TO METHOD window

4. Press ▼ to select WPT/PORT SER and press the ENTER soft key or the [ENTER] key.
5. Press the [PLOT] key once or twice to return the plotter display.
6. Press the GO TO soft key. Soft key titles change. If the GO TO soft key is not displayed, press the cursor pad.



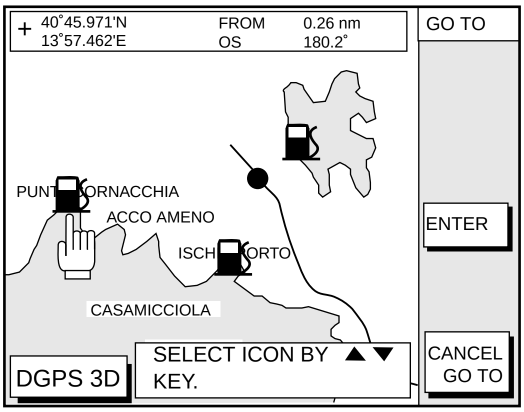
Plotter display

7. Press the NEAR SRVICE soft key.
   The SELECT PORT SERVICE window appears.



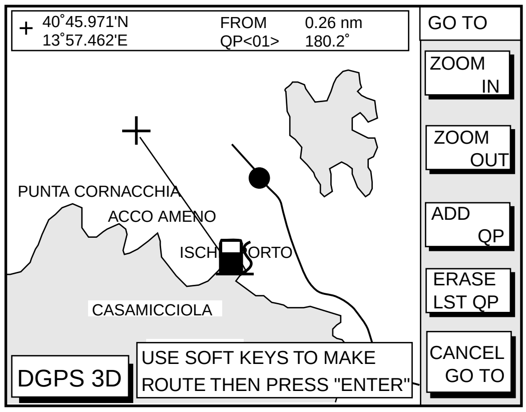
SELECT PORT SERVICE window

8. Use the cursor pad to select service mark desired. Currently selected icon is circumscribed. The name of currently selected icon appears at the top of the window. Refer to the user's manual of C-MAP NT for details about the icons.
9. Press the ENTER soft key or the [ENTER] key. Then, the display shows the locations of those services nearest you.



Sample filling station locations

10. Press ▲ or ▼ to place the "hand cursor" on the port service icon desired and press the ENTER soft key or the [ENTER] key.



Make route window

11. Do one of the following:
   Go directly to port service selected:
   Press the [ENTER] key. The own ship and the port service is connected by a blue line. The range and bearing from own ship to the port service appears at the navigation data display.
   You can go to the port service directly by steering the ship to the heading indicated.

   Go to port service selected via waypoints, make a route as follows:
   a) Move the cursor to the nearest waypoint of the port service.
   b) Press the ADD QP soft key.
   c) Repeat the above steps a) and b) to enter other waypoints.
   d) Press the [ENTER] key to finish.
   A line connects between own ship, waypoints and the port service. Further, the range and bearing from own ship to first waypoint appears.

Note: Destination is automatically cancelled if there is no port for service selected.

11.5 Setting Chart Setup Options

CHART DETAILS menu

1. Press the [MENU] key followed by the CHART SETUP OPTIONS and CHART DETAILS soft key.

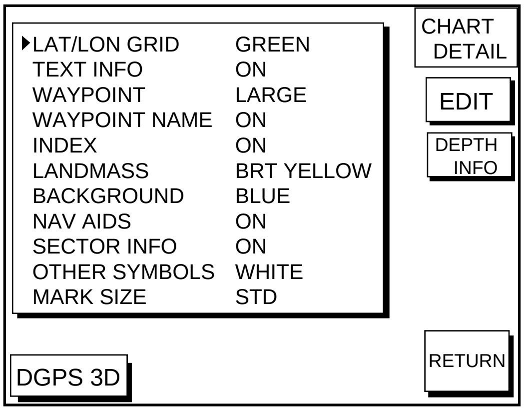


Chart details menu

2. Press ▲ or ▼ to select item and press the EDIT soft key.
3. Select option with cursor pad and press the ENTER soft key or the [ENTER] key.
4. Press the RETURN soft key to finish.

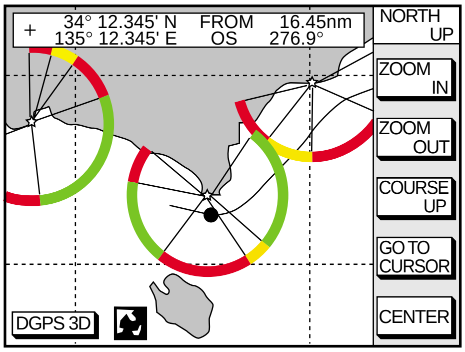
Items which are concerned with C-MAP NT-FP chart cards are described here.

LANDMASS: Selects brightness and color of land. When you select OFF, color of land is black.

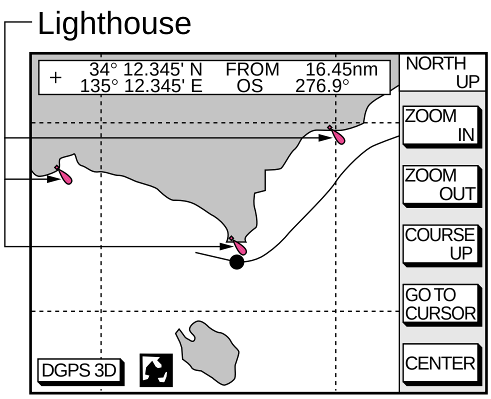
BACKGROUND: Not available with C-MAP NT-FP chart card.

NAV AIDS: Turns aids to navigation symbols (for example, buoys) on/off. When OFF is selected, symbols are displayed but information is not displayed (at the upper part of the screen).

SECTOR INFO: Turns lighthouse viewable angle indication on C-MAP NT-FP chart on/off. Viewing angle is shown as an arc extending from lighthouse position. This feature is available with selected charts. When OFF is selected, the visual information is not displayed and the lighthouse is displayed as "!".



Sector info

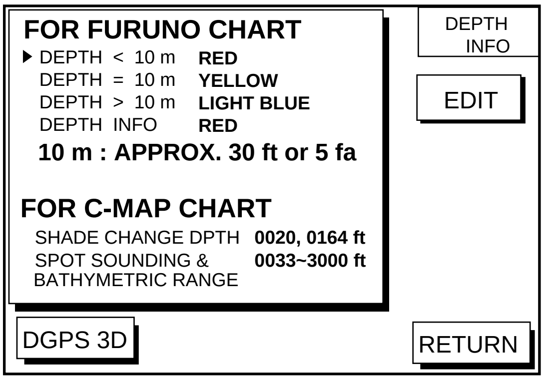


Lighthouse appearance when sector info is off

OTHER SYMBOLS: Selects color of all other chart symbols. When OFF is selected, navaid icons are not displayed but alarm icons are displayed.

DEPTH INFO soft key: Turns the DEPTH INFO display on/off and sets it color on FURUNO charts, or selects the depth areas limit and spot sounding & bathymetric range in C-MAP NT-FP chart.

1. With the CHART DETAILS menu displayed, press the DEPTH INFO soft key to show the following display.



Depth info display

2. Press ▲ or ▼ to select item and press the EDIT soft key or enter the appropriate value by using numeric keys.
3. Select option with cursor pad and press the ENTER soft key or the [ENTER] key.
4. Press the RETURN soft key several times to finish.

SHADE CHANGE DPTH: Sets two values in the range of Depth Limit on the DEPTH INFO display when the C-MAP NT-FP chart is used. The Depth Areas are shown on the screen in three colors depending on depth.

0 to left value: Blue
left value to right value: Light-blue
greater than right value: Light-gray
(Maximum value: 12000 meter or 39369 ft)

In the figure above, as the following,

0 - 20 ft: Blue
20 - 164 ft: Light-blue
greater than 164 ft: Light-gray

Note 1: Depth data depends on the registered value at "depth area".
Note 2: It may be difficult to distinguish colors of track and mark/line in sea areas painted in light-blue or green.

SPOT SOUNDING & BATHYMETRIC RANGE: Sets the depth range to display the spot sounding on the C-MAP NT-FP chart. The depth range is displayed red.

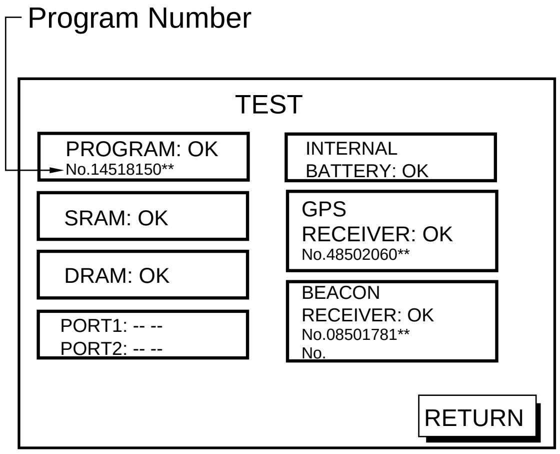
11.6 Selecting Chart Scale/Range

Chart scale (range) may be selected with the ZOOM IN or ZOOM OUT soft key. ZOOM IN expands the chart; ZOOM OUT shrinks it. The range selected is momentarily displayed at the lower left-hand corner.

Note: When the display is expanded or shrunk beyond the range of the chart card in use the chart is not displayed, and an appropriate chart icon appears.

11.7 Displaying Program Number

1. Press the [MENU] key to open the main menu.
2. Press the CONFIGURATION soft key to show the CONFIGURATION n menu.
3. Press the SYSTEM MENU soft key to open the SYSTEM MENU.
4. Press the SELF TEST soft key to open the TEST menu.
5. Press the MEMORY, I/O TEST soft key to start the test. Test results and program numbers. are shown as below.



Memory, I/O test results

12. MAINTENANCE & TROUBLESHOOTING

12.1 Maintenance

Regular maintenance is essential for good performance. A maintenance program should be established and should at least include the items listed in below.

⚠ WARNING

Do not open the equipment.

Hazardous voltage which can cause electrical shock, burn or serious injury exists inside the equipment. Only qualified personnel should work inside the equipment.

Recommended maintenance program

Item	Check point	Remedy
Antenna	Check for loosened and corroded bolts.	Tighten loosened bolts. Replace heavily corroded bolts.
Antenna cable	Check connection point for watertightness.	Replace damaged pats.
	Check connector for tightness and corrosion.	
	Check cables for damage.	
Display unit connectors	Check for tight connection.	Tighten loosened connectors.
Ground terminal	Check for tight connection and corrosion.	Clean or replace as necessary.
Display unit	Dust and foreign material on the display unit.	Dust may be removed with a soft cloth, if necessary anti-static cleaner may be used. Never use chemical solvents to clean the display; they can remove paint and markings.
LCD	Dust and foreign material on the screen.	Wipe the LCD carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove dirt or salt deposits, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt or salt. Change paper frequently so the salt or dirt will not scratch the LCD. Do not use solvents such as thinner, acetone or benzene for cleaning.

12.2 Replacement of Fuse, Battery

The fuse on the power cable protects the system from reverse polarity of the ship's mains and equipment fault. If the fuse blows, find the cause before replacing it. Use only a 3 A fuse. Using the wrong fuse will damage the unit and void the warranty.

⚠ CAUTION

Use the correct fuse.

Use of a wrong fuse can cause fire or damage the equipment.

A battery installed on the circuit board inside display unit preserves data when the power is turned off. The life of the battery is about three years. When the battery voltage is low the battery icon () appears on the display. When this happens, contact your dealer to request replacement of the battery.

	Type	Code Number
Lithium Battery	CR2450-F2 ST2L	000-144-941

Note : Use only the specified battery. Use of an incorrect battery may cause explosion. Dispose of the battery in accordance with local regulations.

12.3 Simple Troubleshooting

Below are simple troubleshooting procedures which the user can follow to restore normal operation.

Simple troubleshooting (plotter)

If …	***Then …***
you cannot turn on the power	check for blown fuse.
	check that the power connector is firmly tightened.
	check for corrosion on power cable connector.
	check for damaged power cable.
	check ship's battery for proper voltage output (12/24 V).
power is on but nothing appears	press the [POWER/BRILL] key and then the cursor pad to adjust display brilliance and tone.
there is no response when a key is pressed	turn on the power again.
position is not fixed within 90 seconds.	check for loosened antenna connector.
	check GPS receiver status indication.
track is not plotted	plotting is stopped. ("H" appears on the plotter display.)
bearing is wrong	check that correct magnetic variation is entered on the DISPLAY OPTIONS menu.
loran or Decca TDs do not appear	check that proper Loran or Decca chain codes are entered on the DISPLAY UNIT.
loran TDs are wrong	enter TD offset on the GPS/DGPS/TD OPTIONS menu.
ship's speed display is not zero after ship is stopped	try to decrease GPS speed smoothing setting on the GPS/DGPS/TD OPTIONS menu.

12.4 Error Messages

The GP-1650W/1650WD displays the following error messages on the alarm menu to alert you to possible trouble.

Error messages

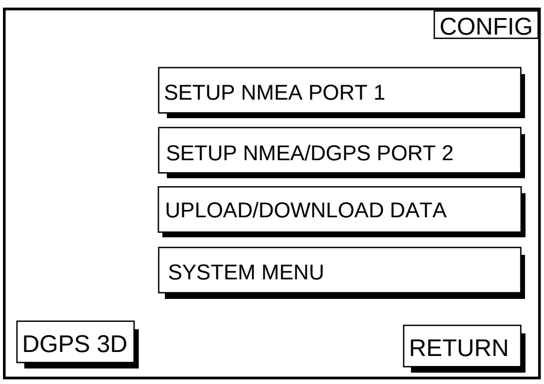
Error Message	Meaning, remedy
NO GPXS FIX	No GPS signal. Check antenna cable.
NO DIFFERENTIAL GPS CORRECTION. (GP-1650WD only)	No DGPS signal. Check antenna.
VOLTAGE OF INTERNAL BATTERY IS LOW.	Voltage of internal battery is low. Request replacement of battery.

12.5 Diagnostic Tests

Memory, I/O port test

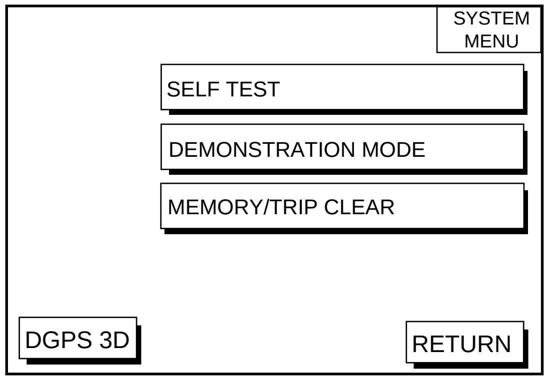
This test conducts a general check of the display unit and the antenna unit. The unit displays the results for each device or component checked as OK or NG (No Good).

1. Press the [MENU] key to open the main menu.
2. Press the CONFIGURATION soft key to show the CONFIGURATION menu.



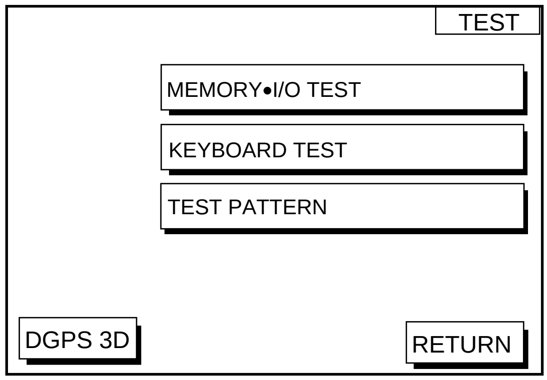
Configuration menu

3. Press the SYSTEM MENU soft key to open the SYSTEM menu.



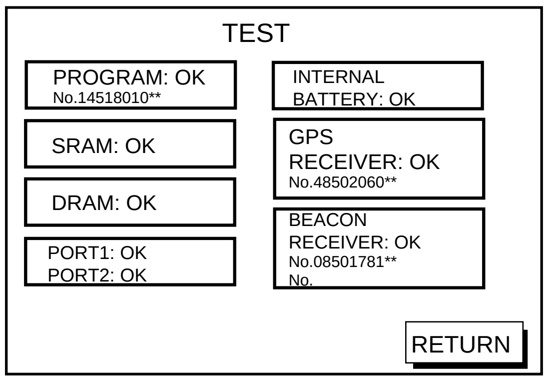
System menu

4. Press the SELF TEST soft key to open the TEST menu.



Test menu

5. Press the MEMORY•I/O TEST soft key to start the test. Test results and program nos. are shown as below.



: Special connections are required to check these ports. Otherwise, "--" appears.
**: Program Version No.

Memory, I/O test results

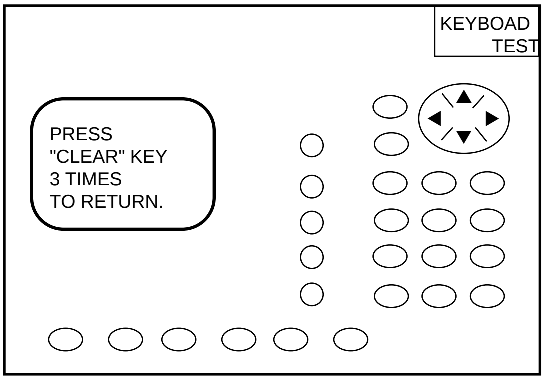
6. The test runs continuously. To return to the TEST menu, press the RETURN soft key.

Note: BEACON RECEIVER results only appear on GP-1650WD.

Keyboard test

This test checks all controls for proper operation.

1. Press the [MENU] followed by the CONFIGURATION, SYSTEM MENU and SELF TEST soft keys to display the TEST menu.
2. Press the KEYBOARD TEST soft key to display the screen for testing the keyboard.

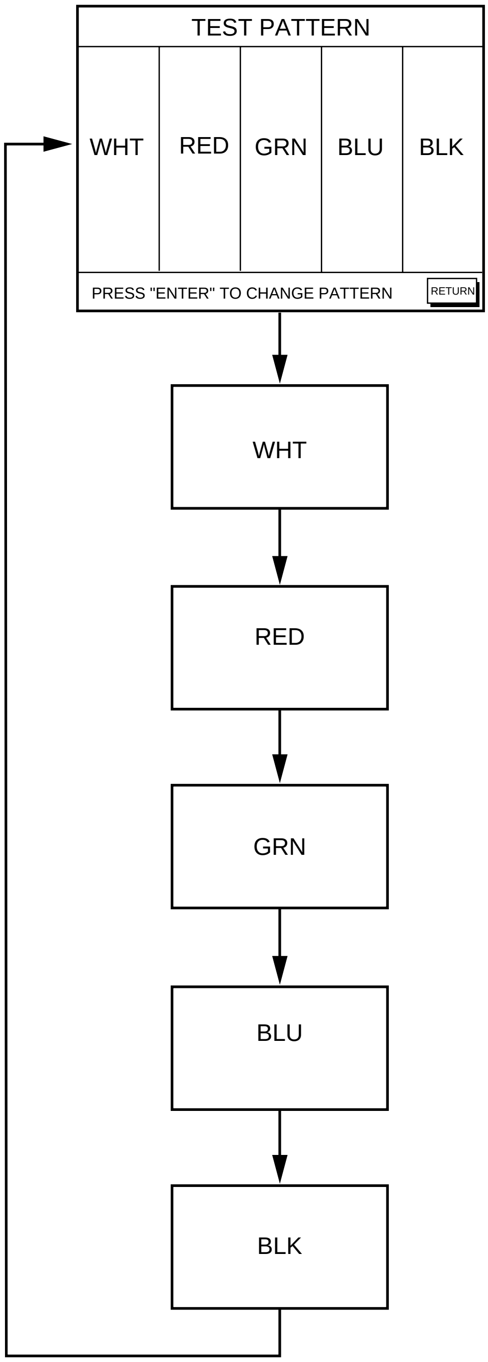


Keyboard test

3. Press each key one by one. The pressed key's on-screen location turns black if the key is functioning properly.
4. To escape, press the [CLEAR] key three times.

Display test

1. Press the [MENU] key followed by the CONFIGURATION, SYSTEM MENU and SELF TEST soft keys to display the TESTmenu.
2. Press the TEST PATTERN soft key to open the test pattern display.
3. Press the [ENTER] key to change the test pattern.

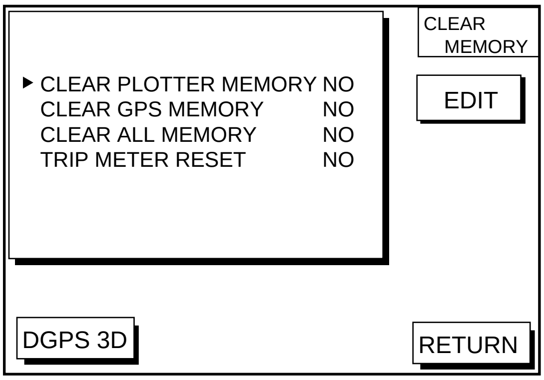


Display test pattern

12.6 Clearing Memories

The memory, which stores marks, tracks and initial settings, can be cleared to start afresh. When this done all default settings are restored.

1. Press the [MENU] key followed by the CONFIGURATION and SYSTEM MENU soft key.
2. Press the MEMORY/TRIP CLEAR soft key to open the clear memory menu.



Clear memory menu

3. Press ▲ or ▼ to select memory or trip meter reset.
4. Press the EDIT soft key.
5. Press ▲ to select YES.
6. Press the ENTER soft key or the [ENTER] key to clear item selected.

Note: For CLEAR PLOTTER MEMORY and CLEAR ALL MEMORY, all waypoints and routes are cleared and default settings are restored. If you require this data, save it to a PC beforehand.

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MENU TREE

MENU key

Default settings shown in bold italic.

- CHART SETUP OPTIONS
  - CHART OFFSET
  - TRACK CONTROL
    - DISPLAY TRACK (***ON***, OFF)
    - TRACK COLOR (***RED***, YELLOW, GREEN, LIGHT-BLUE, PURPLE, BLUE, WHITE)
    - PLOT (***TIME***, DISTANCE)
    - TIME INTERVAL (***00m10s***)
    - DIST INTERVAL (***00.10nm***)
    - TRACK MAMORY (***2000 POINTS***)
  - CHART DETAILS
    - LAT/LON GRID (***ON***, OFF; ***GREEN***)
    - TEXT INFO (***ON***, OFF)
    - WAYPOINT (***LARGE***, SMALL, OFF)
    - WAYPOINT NAME (***ON***, OFF)
    - INDEX (***ON***, OFF)
    - LANDMASS (***BRT***, DIM, OFF; ***YELLOW***)
    - BACKGROUND (BLACK, ***BLUE***)
    - NAV AIDS (***ON***, OFF)
    - SECTOR INFO (***ON***, OFF)
    - OTHER SYMBOLS (***ON***, OFF; ***WHITE***) (RED, YELLOW, GREEN, LIGHT BLUE, PURPLE, BLUE, WHITE)
    - MARK SIZE (***STD***, SMALL)

Default settings shown in bold italic.

- DEPTH INFO Soft key
  - **FURUNO chart**
    - DEPTH < 10m (***ON***, OFF***; RED***)
    - DEPTH = 10m (***ON***, OFF***; YELLOW***)
    - DEPTH > 10m (***ON***, OFF***; LIGHT BLUE***)
    - DEPTH INFO (***ON***, OFF***; RED***) (COLORS: RED, YELLOW, GREEN, LIGHT BLUE, PURPLE, BLUE, WHITE)
    - SPOT SOUNDING & BATHYMETARIC RANGE (0 - 9999 ft,***0 - 33 ft***)
  - **C-MAP NT chart**
    - SHADE CHANGE DPTH
    - SPOT SOUNDING & BATHYMETRIC RANGE

- DISPLAY OPTIONS
  - RNG & BRG MODE (GREAT CIRCLE, ***RHUMB LINE***)
  - RANGE/SPEED UNIT (***nm/kt***, km/km/h, sm/sm/h)
  - DEPTH UNIT (m, ***ft***, fa)
  - TEMP UNIT (°C, °***F***)
  - LAT/LON DISPLAY (DD°MM.MM', ***DD°MM.MMM'***, DD°MM.MMMM')
  - TIME DISPLAY (12HOUR, ***24HOUR***)
  - WAYPOINTS SW (AUTO1, ***AUTO2***, MANUAL)
  - COURSE VECTOR (VECTOR, ***LINE***, OFF)
  - BEARING (TRUE, ***MAGNETIC***)
  - MAG VARIATION (***AUTO***, MANUAL)
  - TD DISPLAY (***LORAN-C***, DECCA)
  - POSITION DISPLAY (***LAT/LON***, TD)
  - SET GO TO METHOD (***1POINT***, 35POINT, WPT/PORT SERVICE)
  - OPERATION MODE (***PLEASURE***, FISHING1, FISHING 2)
  - LANGUAGE (***ENGLISH***, FRENCH)

- GPS/DGPS/TD OPTIONS
  - GPS SETUP OPTIONS
    - LOCAL TIME OFFSET (***00:00***)
    - GEODETIC DATUMS (***WGS-84***)
    - POS SMOOTHING (***000 sec***)
    - SPD/CSE SMOOTHING (***005 sec***)
    - GPS SPEED AVE (***060 sec***)
    - LAT OFFSET (***0.000'N***)
    - LON OFFSET (***0.000'E***)
    - DISABLE SATELLITE
    - LATITUDE (***38.00.000'N***)
    - LONGITUDE (***123.00.000'W***)
    - ANT. HEIGHT (***005m***)
    - FIX MODE (2D, ***2D/3D***)
  - DGPS/WAAS SETUP OPTIONS
    - DGPS/WAAS MODE (DGPS, WAAS, AUTO, ***OFF***)
    - BEACON FREQUENCY (***AUTO***, MANUAL)
    - BEACON BAUD RATE (***AUTO***, 50, 100, 200)
    - WAAS SEARCH (***AUTO***, MANUAL)
    - CORRECTIONS DATA SET (00 to 99, ***02***)
    - DGPS/WAAS ALARM (ON, ***OFF***)
  - TD SETUP
    - LORAN C (GRI, CORRECTION1, 2)
    - DECCA (DEC CHAIN, CORRECTION1, 2)

Loran C Default: 9940, 11-27 (US West Coast)
Decca Default: Chain: 01, R-G (South Baltic)

①

①

- CONFIGURATION
  - SETUP NMEA PORT 1
    - FORMAT (NMEA0183Ver.1.5, ***2.0***)
    - LAT/LON FORMAT (DD°MM.MM', ***DD°MM.MMM'***, DD°MM.MMMM)
  - SETUP NMEA/DGPS PORT 2
    - FORMAT (NMEA0183Ver.1.5, 2.0, RTCM104EX, ***RTCM104INTRN***, RTCM104OUT)
    - LAT/LON FORMAT (DD°MM.MM', ***DD°MM.MMM'***, DD°MM.MMMM)
  - SELECT SNTNC. soft key
    - (AAM, ***APB***, BOD, BWC/BWR*, GGA, ***GLL***, MTW, RMA, ***RMB***, ***RMC***, ***VTG***, WPL, XTE, ***ZDA***)

      *: BWR: For RHUMB LINE
      BWC: For GREAT CIRCLE
  - UPLOAD/DOWNLOAD DATA
    - DOWNLOAD WAYPOINT/RTE TO PC
    - UPLOAD WAYPOINT/RTE FROM PC
    - SAVE DATA TO MEMORY CARD
    - LOAD DATA FROM MEMORY CARD
  - SYSTEM MENU
    - SELF TEST (MEMORY, I/O; KEYBOARD; TEST PATTERN, REMOTE CONTROLLER TEST)
    - DEMONSTRATION MODE
      - DEMO MODE
      - DEMO SPEED
      - DEMO START LAT
      - DEMO START LON
    - MEMORY/TRIP CLEAR
      - CLEAR PLOTTER MEMORY (***NO***, YES)
      - CLEAR GPS MEMORY (***NO***, YES)
      - CLEAR ALL MEMORY (***NO***, YES)
      - TRIP METER RESET (***NO***, YES)

[WPT/RTE] key

- WAYPOINTS
  - LOCAL LIST
  - ALPHA/NUMERIC LIST
  - WAYPOINT BY CURSOR
  - WAYPOINT BY RANGE & BEARING
- ROUTES
- LOG
- CREATE VOYAGE BASED ROUTE

[ALARM] key

Page 1

- AUDIO ALARM (***ON***, OFF)
- ARRIVAL ALARM (ON, ***OFF***)
- ANCHOR ALARM (ON, ***OFF***)
- PROXIMITY ALARM (ON, ***OFF***)
- XTE ALARM (ON, ***OFF***)
- SPEED ALARM (WITHIN, OVER/UNDER, ***OFF***)

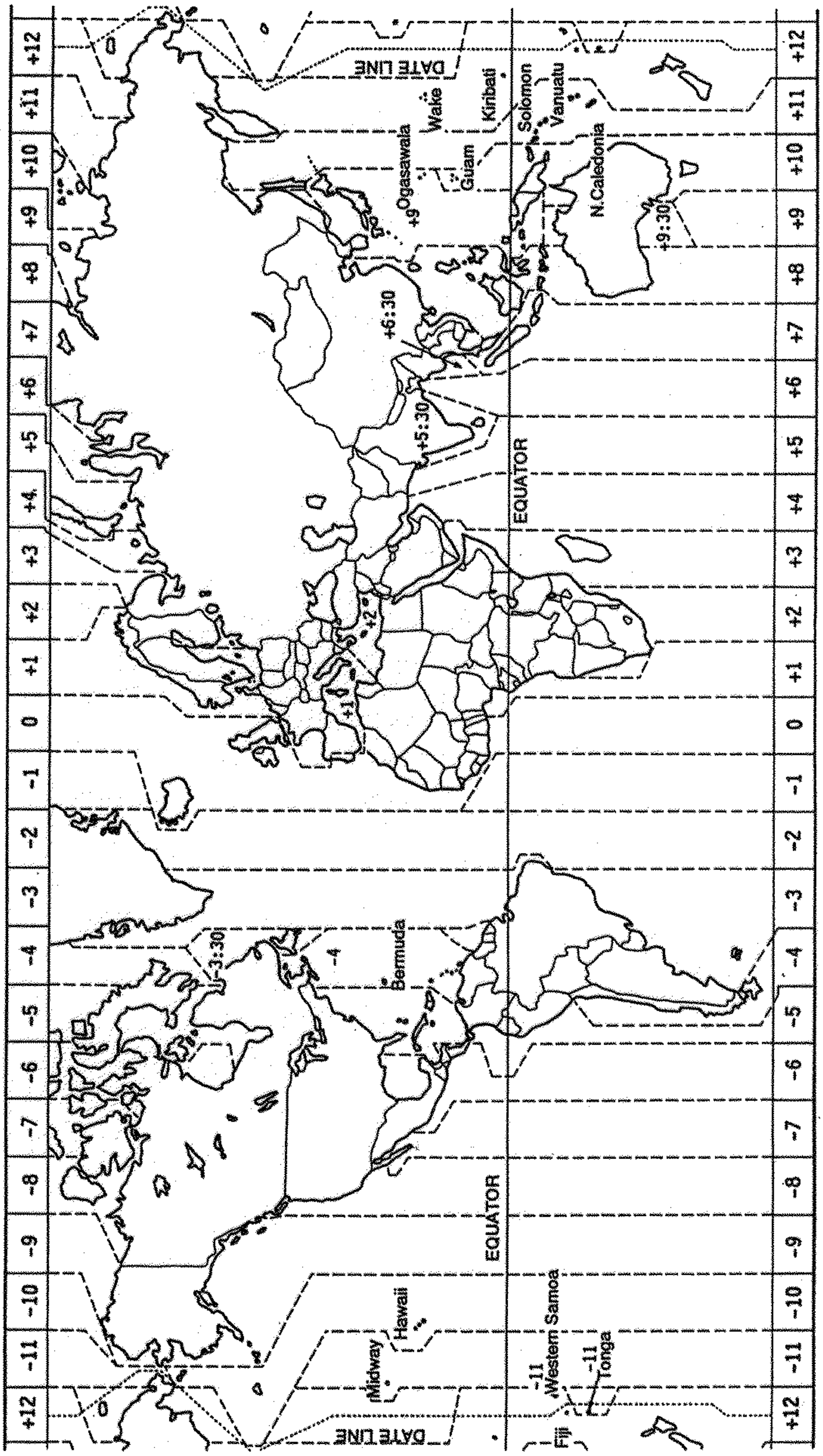
LORAN C CHAINS

Chain	GRI	S1	S2	S3	S4	S5
Central Pacific	4990	11	29	–	–	–
Canadian East Coast	5930	11	25	38	–	–
Commando Lion (Korea)	5970	11	31	42	–	–
Canadian West Coast	5990	11	27	41	–	–
South Saudi Arabia	7170	11	26	39	52	–
Labrador Sea	7930	11	26	–	–	–
Eastern Russia	7950	11	30	46	61	–
Gulf of Alaska	7960	11	26	44	–	–
Norwegian Sea	7970	11	26	46	60	–
Southeast USA	7980	11	23	43	59	–
Mediterranean Sea	7990	11	29	47	–	–
Western Russia	8000	10	25	50	65	–
North Central USA	8290	11	27	42	–	–
North Saudi Arabia	8990	11	25	40	56	69
Great Lakes	8970	11	28	44	59	–
South Central USA	9610	11	25	40	52	65
West Coast USA	9940	11	27	40	–	–
Northeast USA	9960	11	25	39	54	–
Northwest Pacific (old)	9970	11	30	55	81	–
Icelandic	9980	11	30	–	–	–
North Pacific	9990	11	29	43	–	–
Suez	4991	10	24			
England, France	8940	12	30			
Northwest Pacific	8930	11	30	50	70	
Newfoundland East Coast	7270	11	25			
Lessay	6731	10	39			
BØ	7001	11	27			
Sylt	7499	11	26			
Ejde	9007	10	23	38		
Saudia Arabia North	8830	11	25	39	56	
Saudia Arabia South	7030	11	25	37	55	

DECCA CHAINS

Chain No.	Chain	Chain code	Location	Chain no.	Chain	Chain code	Location
01	South Baltic	0A	Europe	34	Kanto	8C	Japan
02	Vestlandet	0E	"	35	Shikoku	4C	"
03	Southwest British	1B	"	36	Hokuriku	2C	"
04	Northumbrian	2A	"	37	Kita Kyushu	7C	"
05	Holland	2E	"	38	Namaqualand	4A	Southern Africa
06	North British	3B	"	39	Cape	6A	"
07	Lofoten	3E	"	40	Eastern Province	8A	"
08		3F	"	41	South West Africa	9C	"
09	North Baltic	4B	"	42	Natal	10C	"
10	North West	4C	"	43	Dampier	8E	Australia
11	Trondelag	4E	"	44	Port Headland	4A	"
12	English	5B	"	45	Anticosti	9C	Northern America
13	North Bothnian	5F	"	46	East Newfoundland	2C	"
14	Southern Spanish	6A	"	47	Cabot Strait	6B	"
15	North Scottish	6C	"	48	Nova Scotia	7C	"
16	Gulf of Finland	6E	"				
17	Danish	7B	"				
18	Irish	7D	"				
19	Finnmark	7E	"				
20	French	8B	"				
21	South Bothnian	8C	"				
22	Hebridean	8E	"				
23	Frisian Islands	9B	"				
24	Helgeland	9E	"				
25	Skagerrak	10B	"				
26	North Persian Gulf	5C	Persian Gulf & India				
27	South Persian Gulf	1C	"				
28	Bombay	7B	"				
29	Calcutta	8B	"				
30	Bangladesh	6C	"				
31	Saliyah	2F	"				
32	Hokkaido	9C	Japan				
33	Tohoku	6C	"				

WORLD TIME



+12
+11
+10
+9
+8
+7
+6
+5
+4
+3
+2
+1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
+12
DATE LINE
EQUATOR
Wake
Kiribati
Solomon
Vanuatu
Ogasawala
Guam
N.Caledonia
+9:30
+6:30
+5:30
-3:30
Bermuda
Hawaii
Midway
Western Samoa
Tonga
Fiji

GEODETIC CHART LIST

001: WGS84
002: WGS72
003: TOKYO : Mean Value (Japan, Korea & Okinawa)
004: NORTH AMERICAN 1927 : Mean Value (CONUS)
005: EUROPEAN 1950 : Mean Value
006: AUSTRALIAN GEODETIC 1984 : Australia & Tasmania
007: ADINDAN-MN : Mean Value (Ethiopia & Sudan)
008: ADINDAN-E : Ethiopia
009: ADINDAN-MA : Mali
010: ADINDAN-SE : Senegal
011 ADINDAN-SU : Sudan
012: AFG : Somalia
013: AIN EL ABD 1970 : Bahrain Is.
014: ANNA 1 ASTRO 1965 : Cocos Is.
015: ARC 1950-MN : Mean Value
016: ARC 1950-B : Botswana
017: ARC 1950-L : Lesotho
018: ARC 1950-M : Malawi
019: ARC 1950-S : Swaziland
020: ARC 1950-ZR : Zaire
021: ARC 1950-ZM : Zambia
022: ARC 1950-ZB : Zimbabwe
023: ARC 1960-MN : Mean Value (Kenya & Tanzania)
024: ARC 1960-K : Kenya
025: ARC 1960-T : Tanzania
026: ASCENSION IS. 1958 : Ascension Is.
027: ASTRO BEACON “E” : Iwo Jima Is.
028: ASTRO B4 SOR. ATOLL : Tern Is.
029: ASTRO POS 71/4 : St. Helena Is.
030: ASTRONOMIC STATION 1952 : Marcus Is.
031: AUSTRALIAN GEODETIC 1966 : Australia & Tasmania
032: BELLEVUE (IGN) : Efate & Erromango Islands
033: BERMUDA 1957 : Bermuda Islands
034: BOGOTA OBSERVATORY : Columbia
035: GAUPO INCHAUSPE : Argentina
036: CANTON IS. 1966 : Phoenix Islands
037: CAPE : South Africa
038: CAPE CANAVERAL : Mean Value (Florida & Bahama Islands)
039: CARTHAGE : Tunisia
040: CHATHAM 1971 : Chatham Is. (New Zealand)
041: CHUA ASTRO : Paraguay
042: CORREGO ALEGRE : Brazil
043: DJAKARTA (BATAVIA) : Sumatra Is. (Indonesia)
044: DOS 1968 : Gizo Is. (New Georgia Is.)
045: EASTER IS. 1967 : Easter Is.
046: EUROPEAN 1950-WE : Western Europe
047: EUROPEAN 1950-CY : Cyprus
048: EUROPEAN 1950-EG : Egypt
049: EUROPEAN 1950-ESC : England, Scotland, Channel & Shetland Islands
050: EUROPEAN 1950-EIS : England, Ireland, Scotland, & Shetland Islands
051: EUROPEAN 1950-GR : Greece
052 EUROPEAN 1950-IR : Iran
053: EUROPEAN 1950-SA : Italy, Sardinia
054: EUROPEAN 1950-SI : Italy, Sicily
055: EUROPEAN 1950-NF : Norway & Finland
056: EUROPEAN 1950-PS : Portugal & Spain
057: EUROPEAN 1979 : Mean Value
058: GANDAJIKA BASE : Republic of Maldives
059: GEODETIC DATUM 1949 : New Zealand
060: GUAM 1963 : Guam Is.
061: GUX 1 ASTRO : Guadalcanal Is.
062: HJORSEY 1955 : Iceland
063: HONG KONG 1363 : Hong Kong
064: INDIAN-TV : Thailand & Vietnam
065: INDIAN-BIN : Bangladesh, India & Nepal
066: IRELAND 1965 : Ireland
067: ISTS 073 ASTRO 1969 : Diego Garcia
068: JOHNSTON IS. 1961 : Johnston Is.
069: KANDAWALA : Sri Lanka
070: KERGUELEN IS. : Kerguelen Is.
071: KERTAU 1948 : West Malaysia & Singapore
072: LA REUNION : Mascarene Is.
073: L. C. 5 ASTRO : Cayman Brac Is.
074: LIBERIA 1964 : Liberia
075: LUZON : Philippines (excl. Mindanao Is.)
076: LUZON-M : Mindanao Is.
077: MAHE 1971 : Mahe Is.
078: MARCO ASTRO : Salvage Islands
079: MASSAWA : Eritrea (Ethiopia)
080: MERCHICH : Morocco
081: MIDWAY ASTRO 1961 : Midway Is.
082: MINNA : Nigeria
083: NAHRWAN-O : Masirah Is. (0man)
084: NAHRWAN-UAE : United Arab Emirates
085: NAHRWAN-SA : Saudi Arabia
086: NAMIBIA : Namibia
087: MAPARIMA, BWI : Trinidad & Tobago
088: NORTH AMERICAN 1927WU : Western United States
089: NORTH AMERICAN 1927EU : Eastern United States
090: NORTH AMERICAN 1927AK : Alaska
091: NORTH AMERICAN 1927BH : Bahamas (excl. San Salvador Is.)
092: NORTH AMERICAN 1927SS : Bahamas, San Salvador Is.
093: NORTH AMERICAN 1927CN : Canada (incl. Newfoundland Is.)
094: NORTH AMERICAN 1927AB : Alberta & British Columbia
095: NORTH AMERICAN 1927EC : East Canada
096: NORTH AMERICAN 1927MO : Manitoba & Ontario
097: NORTH AMERICAN 1927NE : Northwest Territories & Saskatchewan
098: NORTH AMERICAN 1927YK : Yukon
099: NORTH AMERICAN 1927CZ : Canal Zone
100: NORTH AMERICAN 1927CR : Caribbean
101: NORTH AMERICAN 1927CA : Central America
102: NORTH AMERICAN 1927CU : Cuba
103: NORTH AMERICAN 1927GR : Greenland
104: NORTH AMERICAN 1927MX : Mexico
105: NORTH AMERICAN 1983AK : Alaska
106: NORTH AMERICAN 1983CN : Canada
107: NORTH AMERICAN 1983CS : CONUS
108: NORTH AMERICAN 1983MX : Mexico, Central America
109: OBSERVATORIO 1966 : Corvo & Flores Islands (Azores)
110: OLD EGYPTIAN 1930 : Egypt
111: OLD HAWAIIAN-MN : Mean Value
112: OLD HAWAIIAN-HW : Hawaii
113: OLD HAWAIIAN-KA : Kauai
114: OLD HAWAIIAN-MA : Maui
115: OLD HAWAIIAN-OA : Oahu
116: OMAN : Oman
117: ORDNANCE SURVEY OF GREAT BRITAIN 1936-MN: Mean Value
118: ORDNANCE SURVEY OF GREAT BRITAIN 1936-E: England
119: ORDNANCE SURVEY OF GREAT BRITAIN 1936-IM: England, Isle of Man & Wales
120: ORDNANCE SURVEY OF GREAT BRITAIN 1936-SSI: Scotland, & Shetland Islands
121: ORDNANCE SURVEY OF GREAT BRITAIN 1936-WL: Wales
122: PICO DE LAS NIVIES : Canary Islands
123: PITCAIRN ASTRO 1967 : Pitcairn Is.
124: PROVISIONS SOUTH CHILEAN 1963: South Chile (near 53°S)
125: PROVISIONAL SOUTH AMERICAN 1956MN: Mean Value
126: PROVISIONAL SOUTH AMERICAN 1956BO: Bolivia
127: PROVISIONAL SOUTH AMERICAN 1956NC: Chile-Northern Chile (near 19°S)
128: PROVISIONAL SOUTH AMERICAN 1956SC: Chile-Southern Chile (near 43°S)
129: PROVISIONAL SOUTH AMERICAN 1956CO: Columbia
130: PROVISIONAL SOUTH AMERICAN 1956EC: Ecuador
131: PROVISIONAL SOUTH AMERICAN 1956GY: Guyana
132: PROVISIONAL SOUTH AMERICAN 1956PR: Peru
133: PROVISIONAL SOUTH AMERICAN 1956VN: Venezuela
134: PUERTO RICO : Puerto Rico & Virgin Islands
135: QATAR NATIONAL : Qatar
136: QORNOQ : South Greenland
137: ROME 1940 : Sardinia Islands
138: SANTA BRAZ : Sao Maguel, Santa Maria Islands (Azores)
139: SANTO (DOS) : Espirito Santo Is.
140: SAPPER HILL 1943 : East Falkland Is.
141: SOUTH AMERICAN 1969MN : Mean Value
142: SOUTH AMERICAN 1969AG : Argentina
143: SOUTH AMERICAN 1969BO : Bolivia
144: SOUTH AMERICAN 1969BR : Brazil
145: SOUTH AMERICAN 1969CH : Chile
146: SOUTH AMERICAN 1969CO : Columbia
147: SOUTH AMERICAN 1969EC : Ecuador
148: SOUTH AMERICAN 1969GY : Guyana
149: SOUTH AMERICAN 1969PA : Paraguay
150: SOUTH AMERICAN 1969PR : Peru
151: SOUTH AMERICAN 1969TT : Trinidad & Tobago
152: SOUTH AMERICAN 1969VZ : Venezuela
153: SOUTH ASIA : Singapore
154: SOUTHEAST BASE : Porto Santo & Madeira Islands
155: SOUTHWEST BASE : Faial, Graciosa, Pico, Sao Jorge, & Terceira Is.
156: TIMBALAI 1948 : Brunei & East Malaysia (Sarawak & Sadah)
157: TOKYO JP : Japan
158: TOKYO KP : Korea
159: TOKYO OK : Okinawa
160: TRISTAN ASTRO 1968 : Tristan da Cunha
161: VITI LEVU 1916 : Viti Levu Is. (Fiji Islands)
162: WAKE-ENIWETOK 1960 : Marshall Islands
163: ZANDERIJ : Surinam
164: BUKIT RIMPAH : Bangka & Belitung Islands (Indonesia)
165: CAMP AREA ASTRO : Camp Mcmurdo Area, Antarctica
166: G. SEGARA : Kalimantan Is. (Indonesia)
167: HERAT NORTH : Afghanistan
168: HU-TZU-SHAN : Taiwan
169: TANANARIVE OBSERVATORY 1925 : Madagascar
170: YACARE : Uruguay
171: RT-90 : Sweden
172: Pulkovo 1942 : Russia
173: Finish KKJ : Finland

SPECIFICATIONS OF
COLOR GPS/ PLOTTER: GP-1650W
COLOR DGPS/ PLOTTER: GP-1650WD

1 GENERAL

1.1	Display	5.6-inch high resolution color LCD
1.2	Projection	Mercator
1.3	Usable Area	85° latitude or below
1.4	Display Mode	Plotter, Video pilot, Highway display, Waypoint display
1.5	Alarms	Arrival and Anchor watch, Cross track error and proximity alarms, Ship's speed in and out alarms

2 GPS RECEIVER

2.1	Receiving Channels	
	GPS	12 channels parallel, 12 satellite tracking
	WAAS	1 channel
2.2	Rx Frequency	1575.42 MHz
2.3	Rx Code	C/A code, WAAS
2.4	Position Fixing System	All in view, 8-state Kalman filter
2.5	Position Accuracy	
	GPS	10 m (95% of the time, HDOP $\leq$ 4)
	DGPS	5 m (95% of the time), external data required for GP-1650W
	WAAS	3 m (95% of the time)
2.6	Tracking Velocity	999 kts
2.7	Position-fixing Time	Warm start: 12 s approx., Cold start: 90 s approx.
2.8	Position Update Interval	1 s

3 DISPLAY SECTION

3.1	Effective Area	115.2 × 84.2 mm
3.2	Display Pixels	234 × 320 dots
3.3	Position Indication	Latitude/longitude or Loran C LOP or DECCA LOP

4 PLOTTER

4.1	Effective Projection Area	0.125 nm to 2,048 nm (at equatorial area)
4.2	Track Display	Plot interval: by time (1 to 59 min. 59 sec.) or by distance (0.01 to 99.99 nm)
4.3	Colors	Red, yellow, green, purple, light-blue, blue, white
4.4	Memory Capacity	Track/Mark: 5000 points, waypoint: 800 point
4.5	Storage Capacity	Simple route: 200 routes with 35 waypoints each
4.6	MOB	1 point
4.7	Quick Route	1 course

4.8	Electronic Chart	FURUNO or NAVIONICS chart card available, C-MAP chart card also available for C-MAP NT Model

5 INTERFACE

5.1	Input Data	IEC61162-1, NMEA 0183 Ver1.5 $**DBT, $**DPT, $**MTW, $**TLL, $GPWPL
5.2	Output Data	IEC61162-1, NMEA 0183 Ver1.5 $GPAAM, $GPAPB, $GPBOD, $GPBWR/GPBWC, $GPGLL, $GPGGA, $GPRMA, $GPRMB, $GPRMC, $GPVTG, $GPXTE, $GPZDA, $GPWPL

6 POWER SOURCE

6.1	Display Unit	12-24 VDC: 1.1-0.5 A
6.2	Rectifier (PR-62, option)	100/110/115/220/230 VAC, 1 phase, 50/60 Hz

7 ENVIRONMENTAL CONDITIONS

7.1	Ambient Temperature	
	Antenna Unit	-20°C to + 70°C
	Display Unit	-15°C to +55°C
7.2	Relative Humidity	95% at +40°C
7.3	Waterproofing (IEC 60529)	
	Antenna Unit	IPX6
	Display Unit	IPX5
7.4	Vibration	IEC 60529

8 COATING COLOR

8.1	Display Unit	Cover: Munsell 2.5GY5/1.5, Panel: N3.0
8.2	Antenna Unit	N9.5 (white)

INDEX

FURUNO

FURUNO ELECTRIC CO., LTD.
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Pub NO. DOC-488

Declaration of Conformity CE 0560

We FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

declare under our sole responsibility that the product

Color DGPS/Plotter/Sounder Models:
GP-1650: GPS plotter
GP-1650D: DGPS plotter
GP-1650F: GPS plotter/sounder
GP-1650DF: DGPS plotter/sounder
GP-1650W: GPS/WAAS plotter
GP-1650WD: DGPS/WAAS plotter
GP-1650WF: GPS/WAAS plotter/sounder
GP-1650WDF: DGPS/WAAS plotter/sounder

(Model name, serial number)

are in conformity with the essential requirements as described in the Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment (R&TTE Directive) and satisfies all the technical regulations applicable to the product within this Directive

EN 60945: 1997-01 (IEC 60945 Third edition: 1996-11)
EN 60950: 2000 (IEC 60950 Third edition: 1999-04)

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see

- Statement of Opinion N° 01214010/AA/01 of 18 July 2002 issued by Telefication, The Netherlands
- EMC Test Report FLI 12-98-025 of 2 December 1998 and FLI 12-02-022 of 10 June 2002 prepared by Furuno Labotech International Co., Ltd.
- Safety Test Report FLI 12-02-023 of 28 June 2002 prepared by Furuno Labotech International Co., Ltd.

On behalf of Furuno Electric Co., Ltd.

Nishinomiya City, Japan
August 12, 2002

(Place and date of issue)

Hiroaki Komatsu
Manager,
International Rules and Regulations

(name and signature or equivalent marking of authorized person)